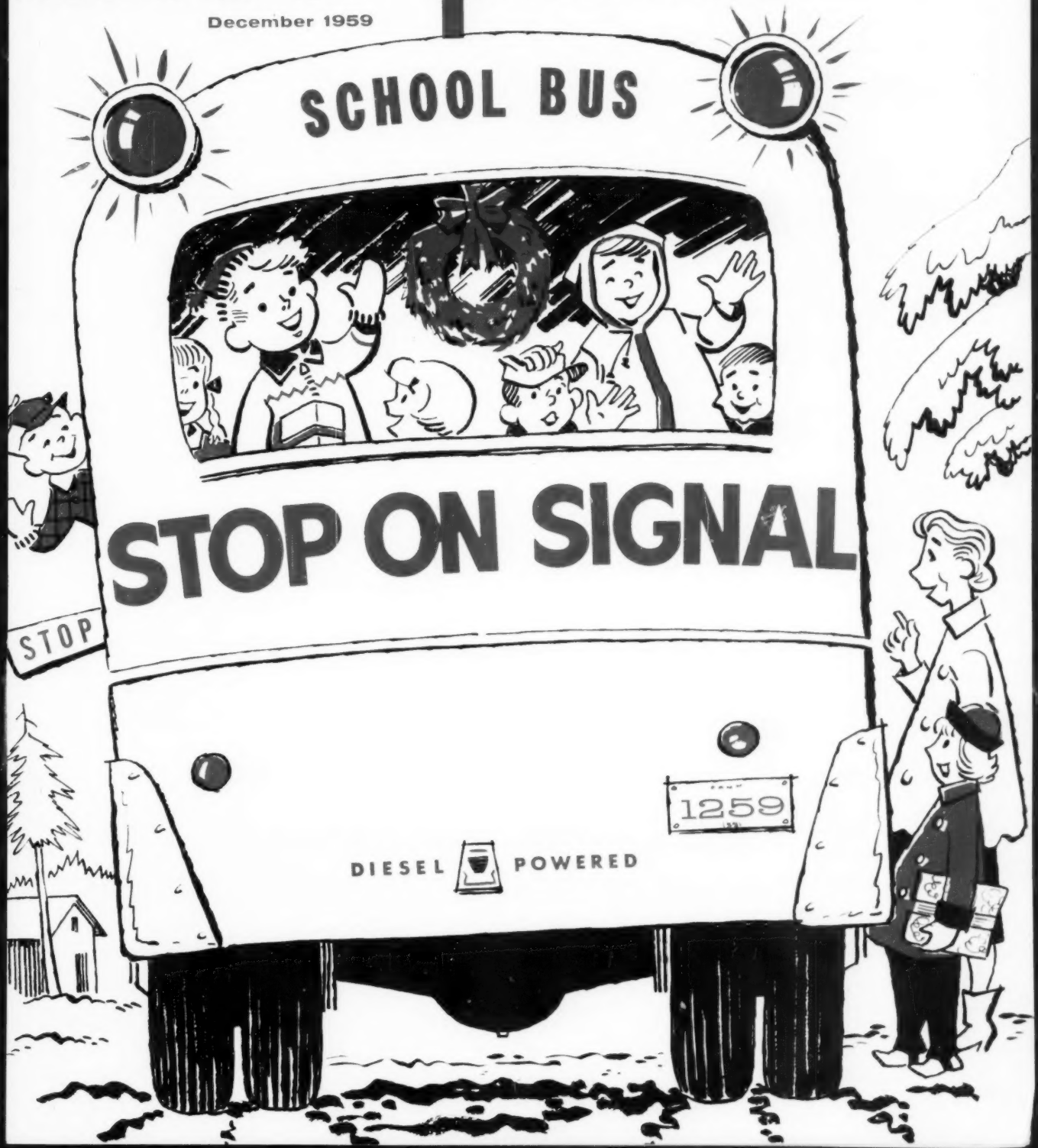
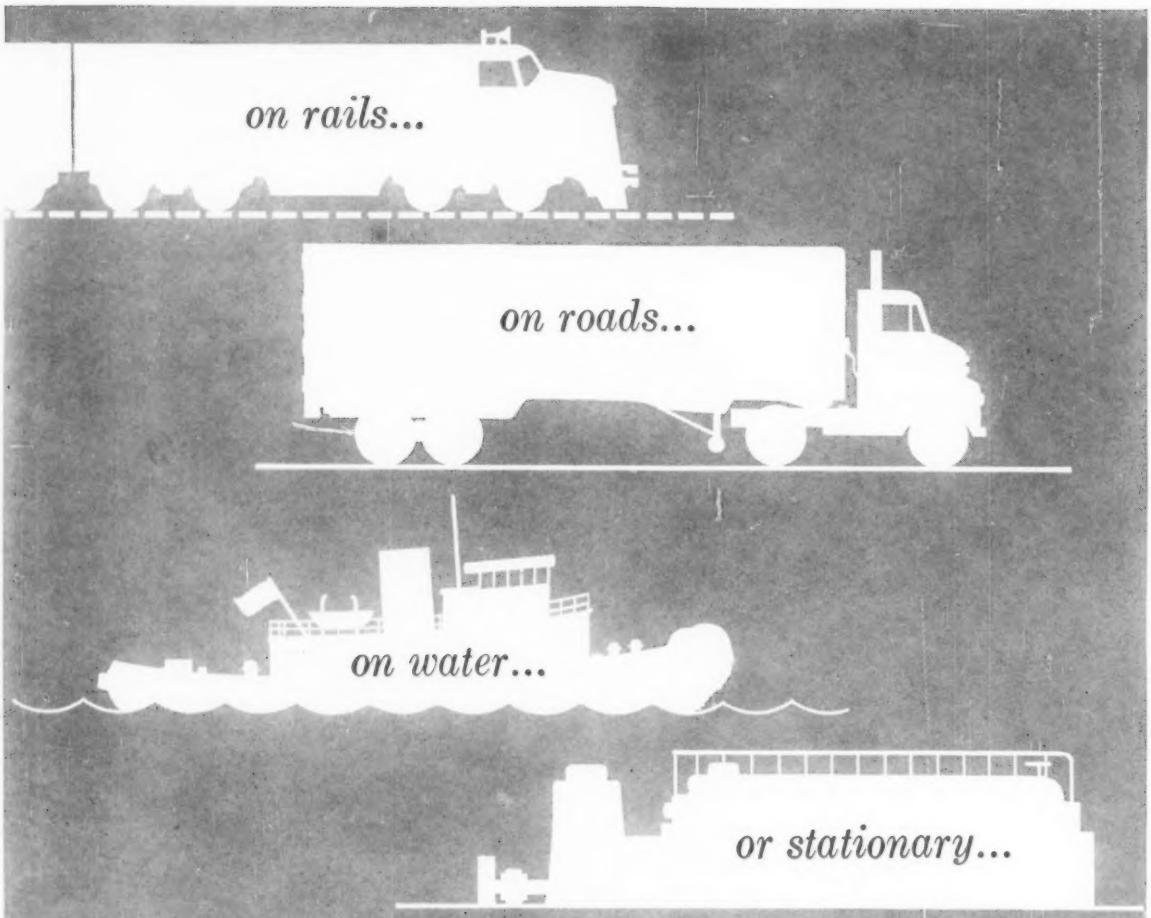
diesel power

December 1959





DIESELS RUN BETTER ON TEXACO URSA OILS

Rings stay free, engines stay clean when they're Texaco lubricated. You get the full compression needed for complete combustion. Your fuel consumption goes down, parts life goes up, maintenance costs are lower.

There is a complete line of Texaco Ursa Oils to meet the exact needs of every type and size of diesel. Your Texaco Lubrication Engineer will gladly help you make the proper selection.

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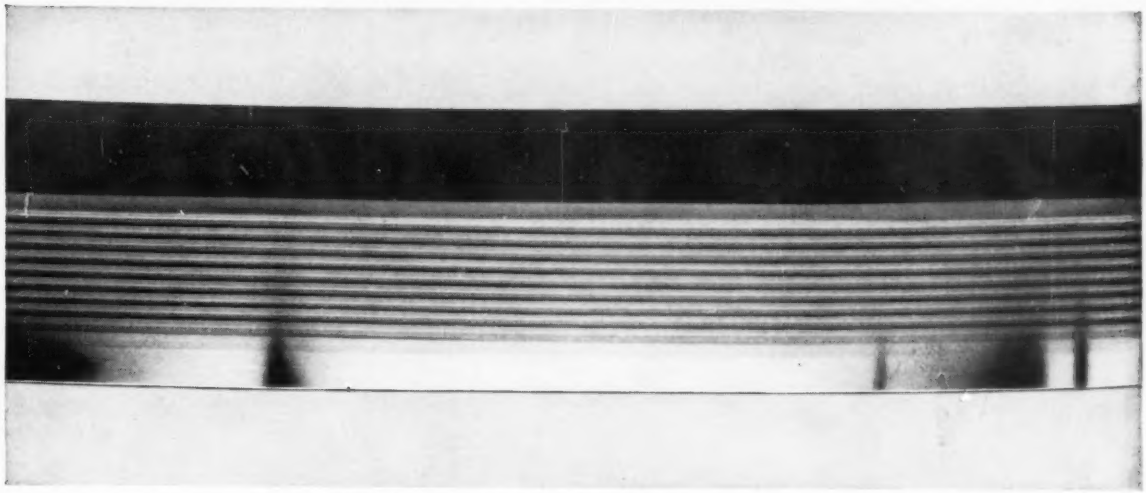
Reduce break-in time by as much as 80%!

with factory pre-seated full chrome
PEDRICK PISTON RINGS



Bright highlight along lower face of ring shows area pre-seated by factory lapping.

Use of PEDRICK Chrome Piston Rings reduces break-in time by as much as 80% . . . allows the engine to be put under full load very quickly. This is because PEDRICK laps or pre-seats its Chrome Rings to cylinder size *at the factory*. PEDRICK Chrome Rings are the most modern twist-seal and/or taper face designs, which further speeds seating and helps provide a quick, positive seal.

All PEDRICK Chrome Rings have a full Chrome coating. Chrome coating on a PEDRICK Ring is never less than .006 inches and may be as much as .010 or .012 inches thick depending upon the size of the ring and the use for which it is intended. On PEDRICK Chrome Rings, thickness of the Chrome coating is measured *after* the lapping operation.

PEDRICK Full Chrome Rings resist scuffing, withstand high temperatures, abrasion and corrosion.

Include PEDRICK top Chrome Rings in your replacement ring sets and increase ring life by as much as four times. A PEDRICK engineer will be glad to call and help you solve any special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Pa., SAratoga 9-3770.

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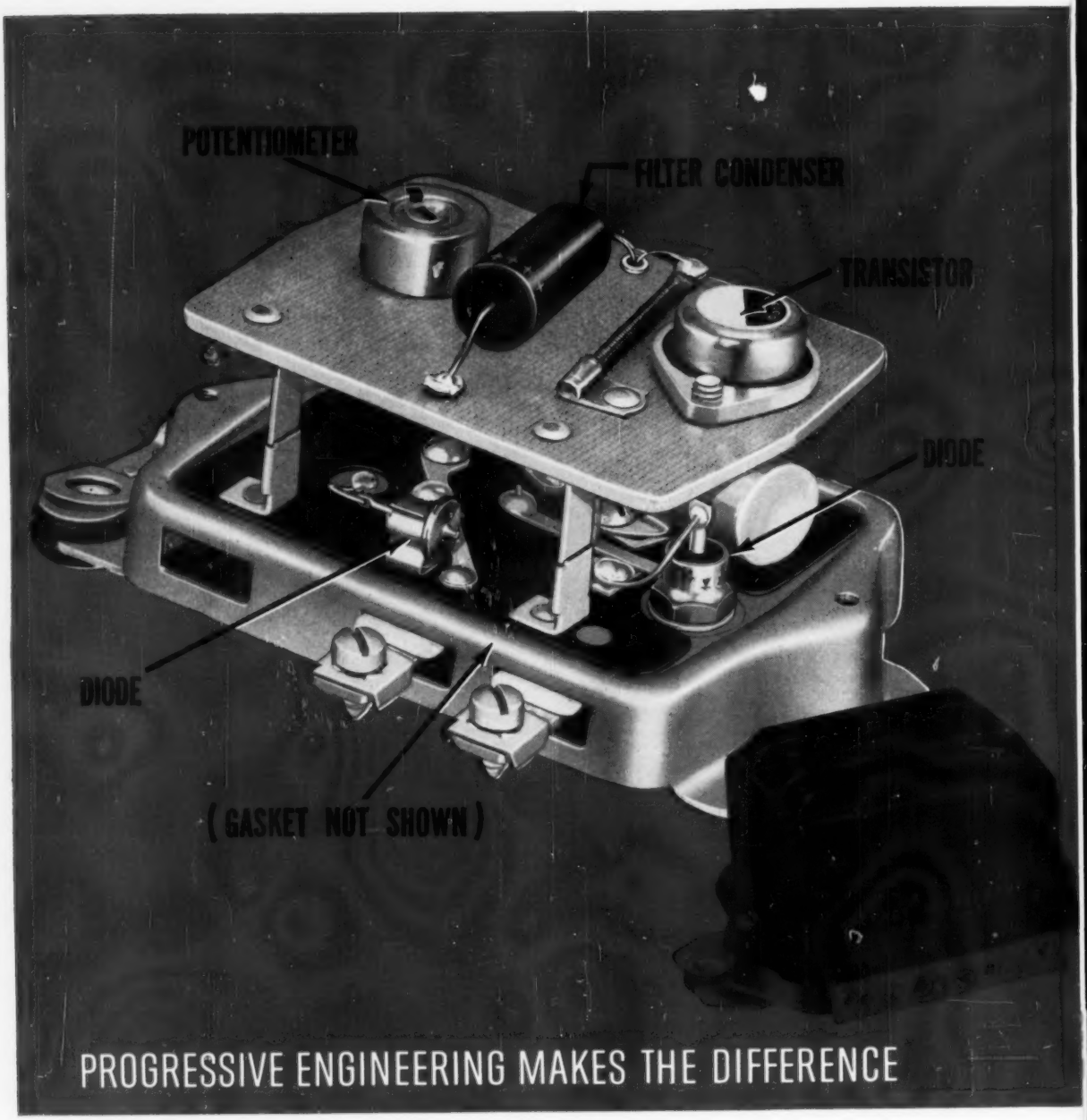


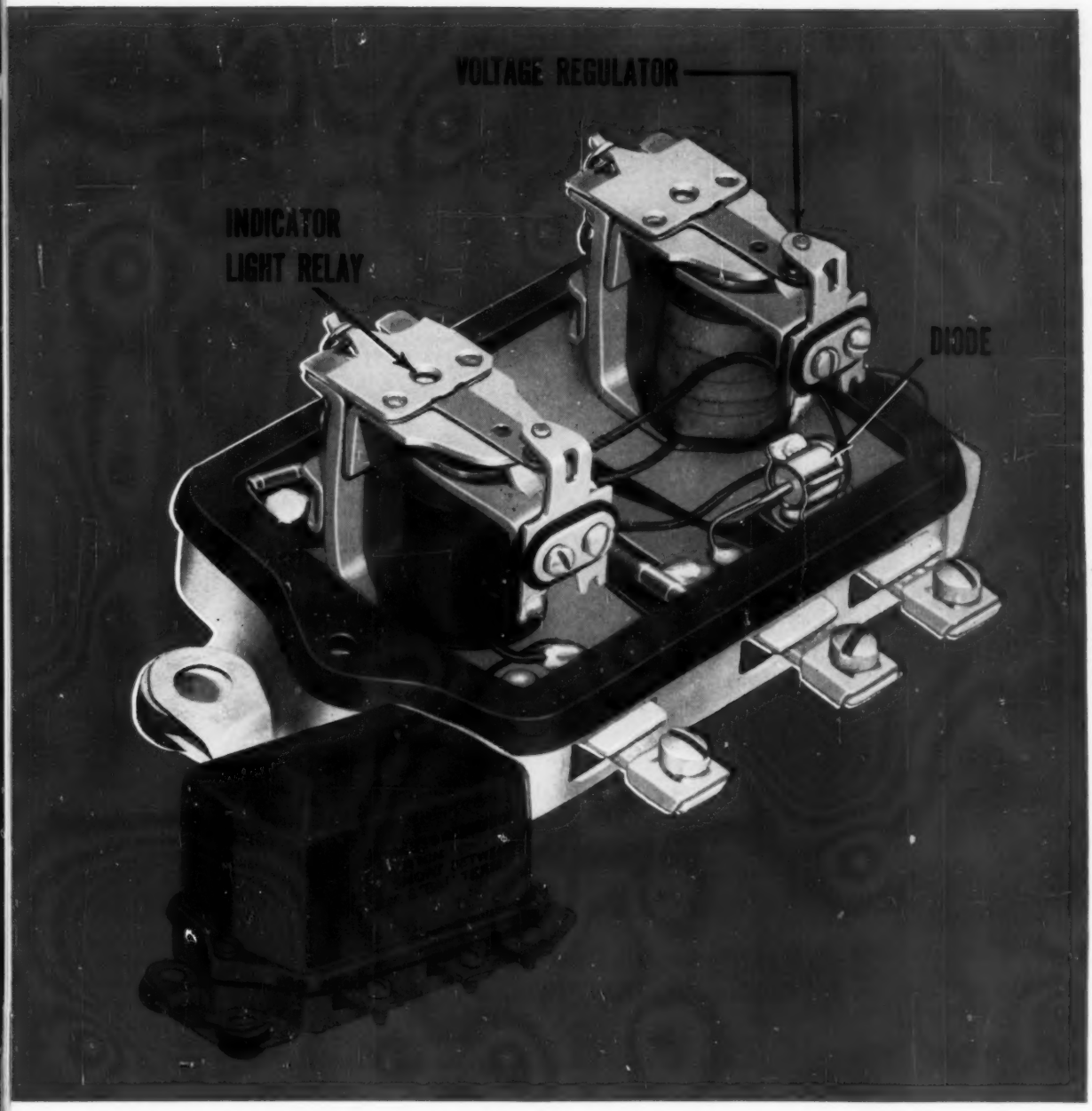
ONLY DELCO-REMY OFFERS FULL-TRANSISTOR

Designed for use with DELCO-REMY'S new self-rectifying a.c. generators

Now you can choose between *two* modern new Delco-Remy regulators—the most accurate available today. One is a full-transistor model, the other transistorized.

The FULL-TRANSISTOR REGULATOR has no moving parts and offers the ultimate in accurate electrical performance, durability and reliability. It is composed entirely of transistors, diodes, condensers and resistors, permitting higher field current for better generator performance. Constant voltage control is unaffected by temperature changes, vibration, or mounting position. A simplified external adjusting feature permits easy voltage setting for varying operating conditions. And this full-transistor regulator requires no periodic servicing.

The TRANSISTORIZED REGULATOR contains a single transistor and diode working in conjunction with a vibrating-type voltage sensing unit. The transistorized circuit



AND TRANSISTORIZED VOLTAGE REGULATORS

permits high field current for improved generator performance with low non-inductive current through the contacts for greatly extended contact life. Models are available for circuits containing either ammeters or indicator lights. All units are temperature compensated to better match battery voltage requirements.

Both the full-transistor and the transistorized models have the same mounting dimensions as standard regulators.

Whichever model you choose for your new vehicles or for replacement on present ones, you can be sure of reduced servicing and extended battery life. Available from your car or truck dealer or through the United Motors System.

FROM THE HIGHWAY TO THE STARS

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ELECTRICAL SYSTEMS

GM GENERAL MOTORS

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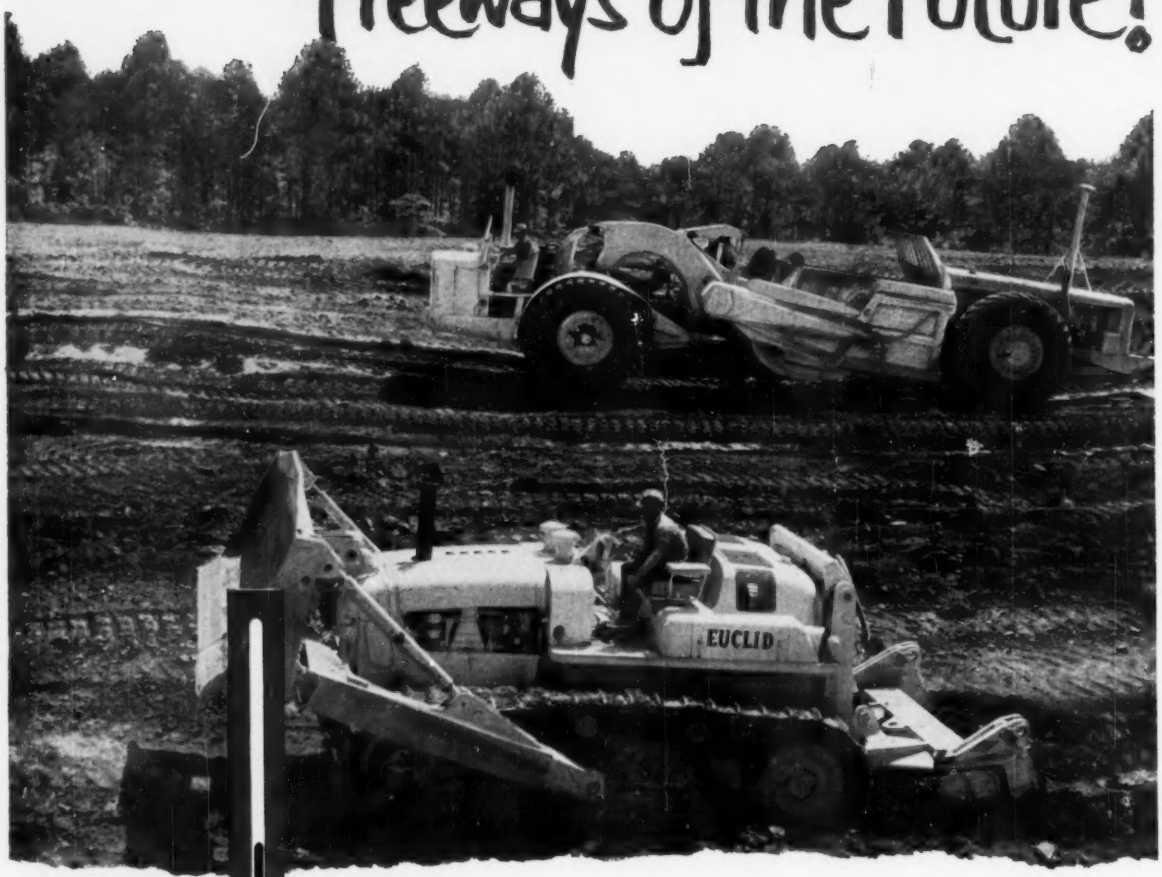
General Motors Reliability in Action...

Freeways of the Future!



Harrison Heat Exchangers —Reliable Products of General Motors Research and Engineering.

Harrison Oil Coolers Bulldoze Heat on Giant Diesel-Powered Road Building Equipment!

Mowing down mountains of earth . . . clearing the way for tomorrow's highways . . . and Harrison handles the heat. Great diesel-powered earth movers such as this crawler tractor and scraper depend on Harrison to hold engine oil temperatures steady. Harrison products are backed by the reliability of General Motors research, design and testing. That's why you'll find Harrison heat exchangers on the most advanced aviation, marine and industrial equipment. Remember, too . . . every Harrison heat exchanger is the product of a half century of manufacturing experience . . . your further assurance of *top quality, top reliability!* If you have a cooling problem, look to Harrison for the answer!

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AIRCRAFT, AUTOMOTIVE, MARINE AND INDUSTRIAL HEAT EXCHANGERS

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORPORATION, LOCKPORT, NEW YORK

editors notes...

You'll want to read about...

Shortest short-haul truck in captivity? Combination wash and de-ice diesel is hard at work for Pan American at Idlewild International Airport . . . she is short on mileage but long on dependability and hard work (Pg. 18)

Diesel school bus market may be worth looking into . . . Cerlist already has an installation . . . check the safety factor, reliability and dependability features . . . this market could be a sleeper. Find out about it on page 20 . . . .

Today's Diesel Man wears two hats this month . . . he's owner operator S. T. Kimmes . . . as his own maintenance supervisor he has some interesting views on diesel-powered equipment— and its relationship to the efficiency and profit of a going construction business . . . starts on page 22 . . . .

Trend to air starting for diesel trailer tractors is discussed by A. G. Ringer of Ingersoll-Rand . . . who cites weight reduction, lower maintenance costs . . . makes a strong case for air starting in this application . . . (Pg. 25)

You'll want to read about...

To turbocharge small engines . . . or not to turbocharge? The key is in proper application, consideration of the work cycle . . . these and other points are covered in this story. If you've been wondering about turbochargers for your application you'll find some of the answers on page 29.

Intercoolers can increase the power potential of turbocharged engines . . . but the application of intercoolers requires analysis. Here is a guide to follow in selecting and applying this effective means of increasing output of turbocharged engines. (Pg. 33).

Balancing filtering effectiveness and cost is the key to economic, efficient filtration . . . and this applies to both fuel oil and lube oil for these have a strong relationship . . . one you can't afford to overlook. Find out about it on page 35 . . .

If you aren't testing all valve springs, whether new or used, you may be penalizing your engine's performance . . . here are some tests that prove facts about new valve springs you ought to know. (Pg. 39) . . .

If you are sales minded read this issue carefully . . . woven through many of the features is an important sales concept we've run across in many areas of the industry . . . if it helps you make an additional sale the time will have been well spent. An investment in knowledge always pays dividends . . .

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DECEMBER, 1959 VOL. 37 NO. 12

diesel power

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BPA

Union Pacific's new and mighty locomotive crests Sherman Hill, Wyoming, with a heavy load.

WORLD'S MOST POWERFUL LOCOMOTIVE SPEEDS FREIGHT ECONOMICALLY WITH BENDIX FUEL AND IGNITION SYSTEMS

This is the world's mightiest self-powered locomotive at work. On level track, it can pull 735 fully loaded freight cars—a train more than seven miles long! Its two engines—an auxiliary diesel engine and a gas-turbine power plant—depend on Bendix fuel injection and ignition systems to help keep its mighty power flowing smoothly and efficiently.

This new gas turbine-electric locomotive, built by General Electric for Union Pacific, is designed to haul freight faster and more economically. It burns less expensive "residual" fuel—a thick, viscous substance with a heavy tar content which must be heated before it will flow freely.

The Bendix ignition system fires this low-volatile fuel as efficiently as volatile gasoline is ignited in your automobile engine. The Bendix fuel injection system is used in the auxiliary diesel engine, which also furnishes power for "yard" movement of the locomotive.

General Electric has been an important builder of locomotives for more than 65 years. To be selected as the supplier of fuel injection and ignition equipment by G.E. for the mightiest locomotive they have ever built, is truly one of the finest tributes that could be paid to the all around efficiency of Bendix equipment.

It is equally impressive that whenever exceptional performance, complete dependability and operating economy are the requirements, diesel engine manufacturers in increasing numbers are turning to Bendix for their fuel injection and ignition requirements.

SCINTILLA DIVISION OF
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Export Sales and Service, Bendix International Division
205 East 42nd Street, New York 17, N.Y.

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SIDNEY, N. Y.

Bendix
AVIATION CORPORATION

Actual photo of a #6 residual fuel of the type burned regularly by two *Enterprise* Engines at the Municipal Power Plant, New Smyrna Beach, Florida.

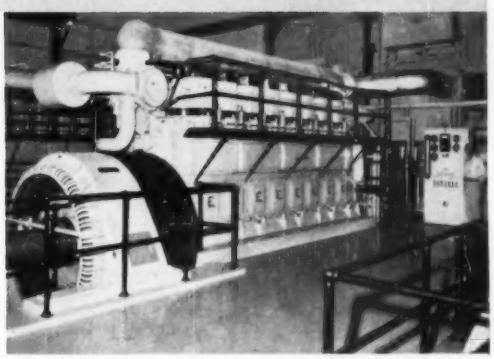
ENTERPRISE Does —and saves this city up to $4200 per month in fuel costs!

Here are facts of interest to any city that is thinking of using low cost residual fuels in engines for electric power generation.

Early in 1957, New Smyrna Beach, Florida put two DSR-38 *Enterprise* Diesels into operation generating 90% of its power load. They burn about 100,000 gallons of #6 residual fuel every month. *Both engines have now run on 80% average load continuously for over a year and a half without shutdown except for normal maintenance—with fuel savings as high as $4200 per month!*

This performance is typical of *Enterprise* Diesels. For they are designed and built to permit the widest possible latitude in fuel use. You can now order your new engine fully equipped for burning residual fuels. Or your present *Enterprise* Diesel can be converted to handle heavy fuel by installing the necessary oil heaters and centrifuges. No change in the basic fuel injection system is required if it's an *Enterprise*.

To be sure your diesel will handle low cost fuels and still turn in maximum performance—*without expensive maintenance and downtime*, specify Enterprise—custom crafted by the engine people that have the heavy fuel experience—and know how to use it!



These two 2500 HP *Enterprise* Model DSR-38 Turbocharged Diesels have turned in record performance on heavy fuel operation. Simple *Enterprise* open-type combustion chamber design makes handling of heavy fuels easy and economical.

ENTERPRISE
engine & machinery co.

DEPENDABLE ENGINES

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18th and Florida Streets, San Francisco 10, California

Boston • Chicago • Jacksonville • Kansas City • Los Angeles
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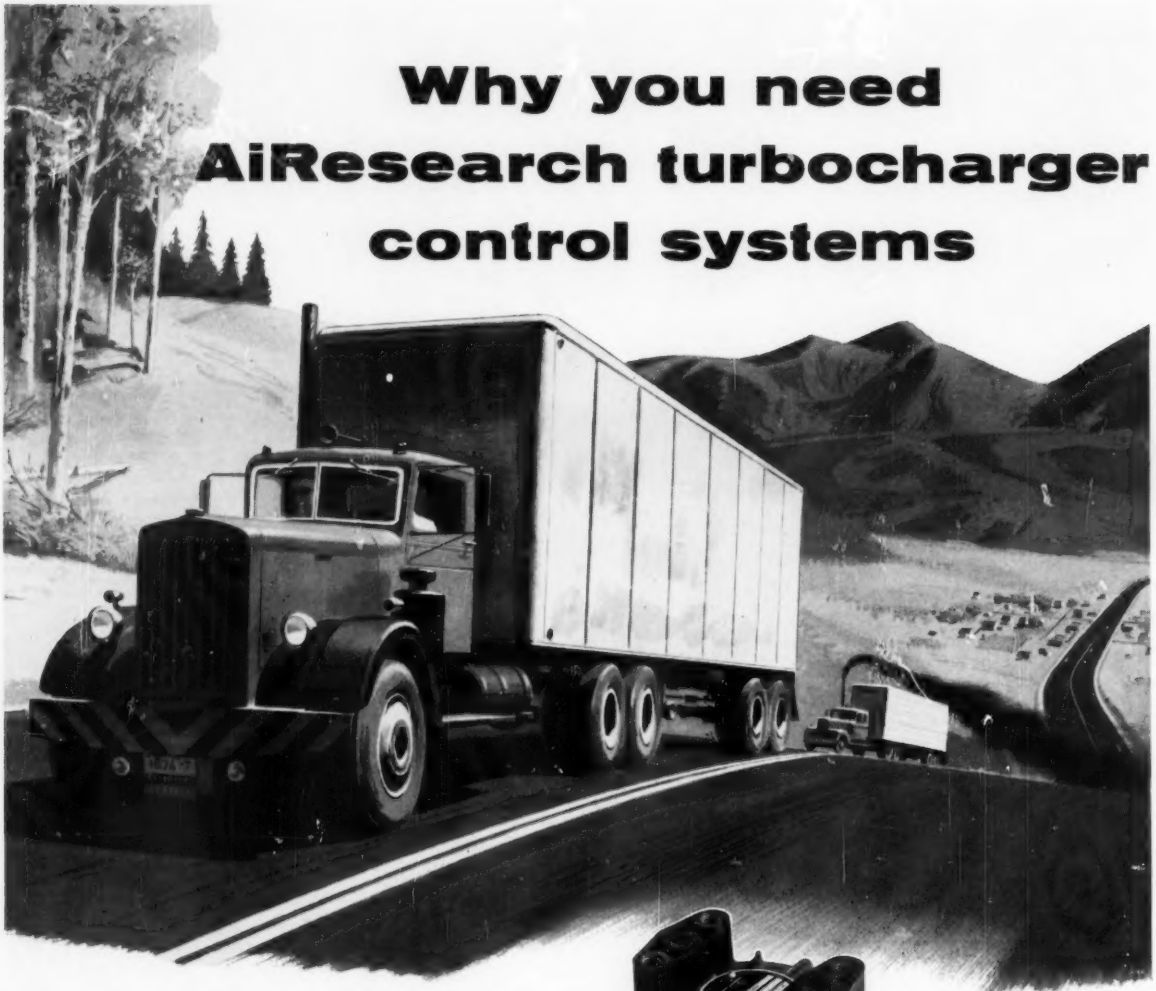
Why you need AiResearch turbocharger control systems



The two components of the AiResearch turbocharger control system are a speed sensor and an exhaust by-pass valve. They control the speed of exhaust-driven turbochargers by modulating the amount of engine exhaust used.

The AiResearch turbocharger control system delivers more air to the turbocharged engine automatically when needed. This more than doubles the torque rise and gives the engine much greater lugging ability under heavy loads.

AiResearch is the leader in the development and production of turbocharger controls for all major diesel engine applications as well as air-cooled turbochargers for diesel engines from 50 to 700 H.P. Your inquiries are invited.

Reduced fuel consumption

•

Smoking eliminated

•

Longer engine life

•

Lower maintenance costs

•

Shorter running time

•

Better engine lugging

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

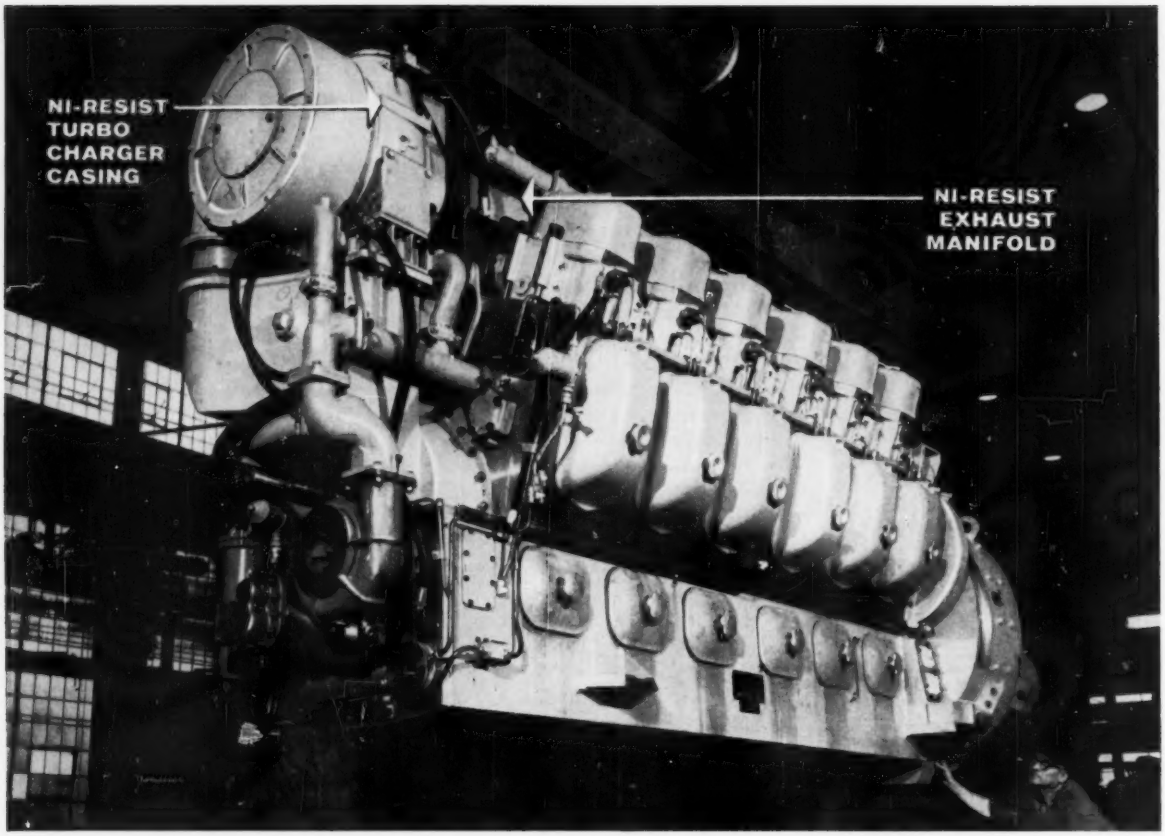
diesel power

editorially speaking

Our Christmas Fable

In this town was the Market of Artisans where many craftsmen lived who did build the engine known as Diesel. Some waxed prosperous, others were in moderate circumstances and still others didst live from hand to mouth. Among all these was a man, once a leading craftsman. But he was not wont to change and was cursed with a strange forgetfullness. As years passed, prosperity also dwindled for him and his stature did decrease. Now it came to pass that the King was to visit the town. More, because of his interest in the engine Diesel, it became known that he would visit the Market of Artisans. For many days there was great stir and bustle as preparations went forward to greet the King in suitable style. But this man who had fallen on evil days understood it not. He would be seen at all times stopping people and asking, "Thy pardon please, who is the King?" And they would turn away, gently or in impatience as suited their temper. Yet none would vouchsafe him an answer. As all things must come to pass, the great day did dawn. Excitement grew and there was great scurry to do all those things yet undone. All gathered in the market place at the appointed time. Finally, the King stood forth for all to behold and a great cry went up. Then, the questioner broke through the multitude and spake thus, "Why, I know this man. I didst try to sell unto him an engine. He bought it not, saying, it fitted not the times or his need. He is a User!" From out the confusion, one craftsman, pitying him, did lead him away, saying, "Yea, the User is King. Once thou didst know this and prospered, but thou didst forget and suffered in consequence. We, too, didst know this but remembered and prospered accordingly. I tell thee this where none other would so that thou might regain a measure of thy former stature, for I am a man of compassion. Others will say, though, that I have rocks in my head for building up a competitor." It is not told whether this man did truly remember and thereby profit. But the moral is plain: Forget that the User is King and you've had it!

B. P. E.



How Ni-Resist cast iron parts help boost efficiency of Alco diesels

High temperature properties of Ni-Resist irons allow more complete conversion of fuel to power

Designers of this modern diesel wanted at least 1800 horsepower, minimum fuel consumption, minimum size and weight.

That meant turbocharging — and higher operating temperatures. And it meant strong alloys for certain critical parts . . . alloys with outstanding resistance to heat, oxidation, and scaling . . . alloys with expansion properties comparable to surrounding metals.

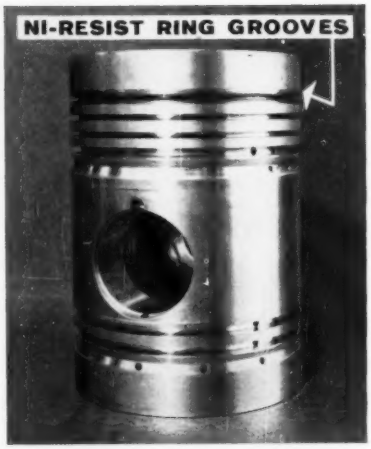
Ni-Resist* cast irons meet need

For exhaust manifolds, Type 3 Ni-Resist iron was selected. This Ni-Resist iron resists scaling and warpage at manifold temperatures. In addition, its low coefficient of expansion prevents undue thermal stresses at the joints with other metals.

For the turbocharger casing, use of Type D-3 Ni-Resist ductile iron gives outstanding strength and toughness at exhaust temperatures.

For power ring groove inserts in aluminum pistons, Type 1 Ni-Resist iron insures strength and heat resistance . . . keeps inserts from pounding out of shape at high operating temperatures. And its high coefficient of expansion closely matches that of aluminum pistons.

Learn more about the resistance of the strong corrosion resisting Ni-Resist cast irons to oxidation, warping, scaling and other metal failures that raise engine maintenance costs. Write for "Engineering Properties and Applications of Ni-Resist" and "Engineering Properties of Ni-Resist Ductile Irons."



THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street INCO New York 5, N. Y.

*Registered Trademark

INCO NICKEL

NICKEL MAKES ALLOYS PERFORM BETTER LONGER

diesel power news section highlights

HOT LINE – A LAST MINUTE TALK WITH DISTRIBUTORS . . .

Right down on the firing line where sales action is what counts . . . the picture varied according to the area, but there are trends across the country . . . MAKE BUSINESS is the big one . . .

IN THE SOUTHWEST

Strong dealer/distributor trend toward tailoring complete units to the needs of local industry . . . good example is Stewart & Stevenson in Houston where expansion includes marrying power with driven equipment . . . they are putting together 300 diesel-generator sets for refrigeration work for Pacific Fruit Express, and this trend is at work on other levels . . . a Cooper Bessemer subsidiary knocking out complete gas-gathering units in both big and small sizes . . . other distributors marketing complete stand-by units, plus a good market in industrial engine-generator sets. It all adds up to making business by satisfying user needs for a complete power facility . . . diesel power that is.

IN THE MID-WEST

Action beginning to pick up after a normally slow period . . . again standby and industrial sales showing strength with marine making progress . . . and coming on hot and heavy-repowering. "We expect to make a good dent in the truck business around here during the busy winter months ahead . . ." one dealer said. He was echoed by others . . . the whole ball of wax being tempered by a dealer in Minnesota . . . "Everybody is watching their dollars these days . . . sure, diesel economy is appealing and we're making sales, but we've got to go out and make them."

IN THE SOUTH

"Irrigation has given us a good market to shoot at . . . so has emergency power in the coast areas . . . but we've got to make business these days." Making business . . . looking for new applications . . . the indication here is part of another overall trend . . . sales aren't coming in over the transom today and the dealer/distributor that wants to do business goes out and looks for it. Generally the year ahead looks good in Dixieland for the wide-awake distributor . . . there was some concern over the steel situation mentioned both here and in other parts of the country.

IN THE EAST

We ran into hard competition here, repowering getting a big play . . . two dealers we know of are locking horns over dieselizing a big fleet. "There is a strong interest growing in diesel economy and we are expanding facilities to go into new lines," one distributor said. Here in the East there is an awareness of the number of new engines on the market, new lines, new imports. But the situation is healthy. Competition means more sales volume . . . means a bigger bite for diesels across the board. Sales are near quotas here and the future looks good, some reporting that they have as much work as they can handle.

MORE NEWS HIGHLIGHTS FOLLOW ►

NEWS SECTION HIGHLIGHTS . . .

IN THE WEST

Imported engines finding strong user interest . . . MAN reported dieselizing a fleet of route vans . . . Perkins "Four 99's" going into truck refrigeration units . . . Volvo doing a lot of repowering, in fact repowering seems to be the big story in the West. Most distributors in this area seem to be doing a lively business . . . things look good for '60.

ACROSS THE BOARD

From coast to coast, things look pretty good. Competition is keen – its a hard-sell market. You've got to go out and get the business was the general feeling. Giving the user what he wants in the way of a complete package makes a strong second point. All this must still be backed up by fast and efficient service. From the distributor point of view, 1960 should be a good year.

CURTISS-WRIGHT INTRODUCES "ROTATING COMBUSTION ENGINE"

Worth watching is the somewhat radical internal combustion engine just announced by Curtiss-Wright. With only two moving parts and the absence of "hot parts" requiring expensive metals, the potential of this engine is tremendous, if . . . our editor asked about detonation and if there were any compression limitations. Much of the details of this engine are still shrouded in secrecy but Curtiss-Wright spokesman indicated that there were no such limitations and that compression ignition appeared feasible.

Also in the news is the dropping by Curtiss-Wright of its interest in the Mercedes-Benz diesels. Reportedly, Studebaker-Packard will pick up part of the line and rest will revert to Daimler-Benz.

STUDEBAKER-OLIVER DEAL POSSIBLE

In view of rumors that have been around for some time, officials of both companies recently released a statement that pointed out the fact that no firm agreement has been made. Sale of Oliver Corp. to Studebaker-Packard may involve cash and stock to the tune of $83 million at current market prices. Negotiations are still in progress and they involve the entire Oliver business.

FORD TO ANNOUNCE DIESEL POWERED TRUCK FOR '61?

Testing is now going on with Cummins and GM diesels, Hercules will be added to the list as Ford gets ready to join diesel heavy-duty market. Fleet testing will probably begin soon. Power plant that gets the nod will have to stand up to results of test on the Super-Duty V-8 gasoline job that piled up 255-thousand miles and after about $80 dollars worth of repair went right back in service.

INDIANA STUDYING TANDEMS FOR TOLL ROADS

At the request of Governor Handley Indiana's toll road authorities are taking a good look at double-bottom trucking on the Indiana Turnpike. Other toll roads have found this a good means of wooing truckers into greater use of the pay-as-you-go super highways. Indiana now offers the extra-added attraction of a special discount on fuel purchased for operation on its toll roads.

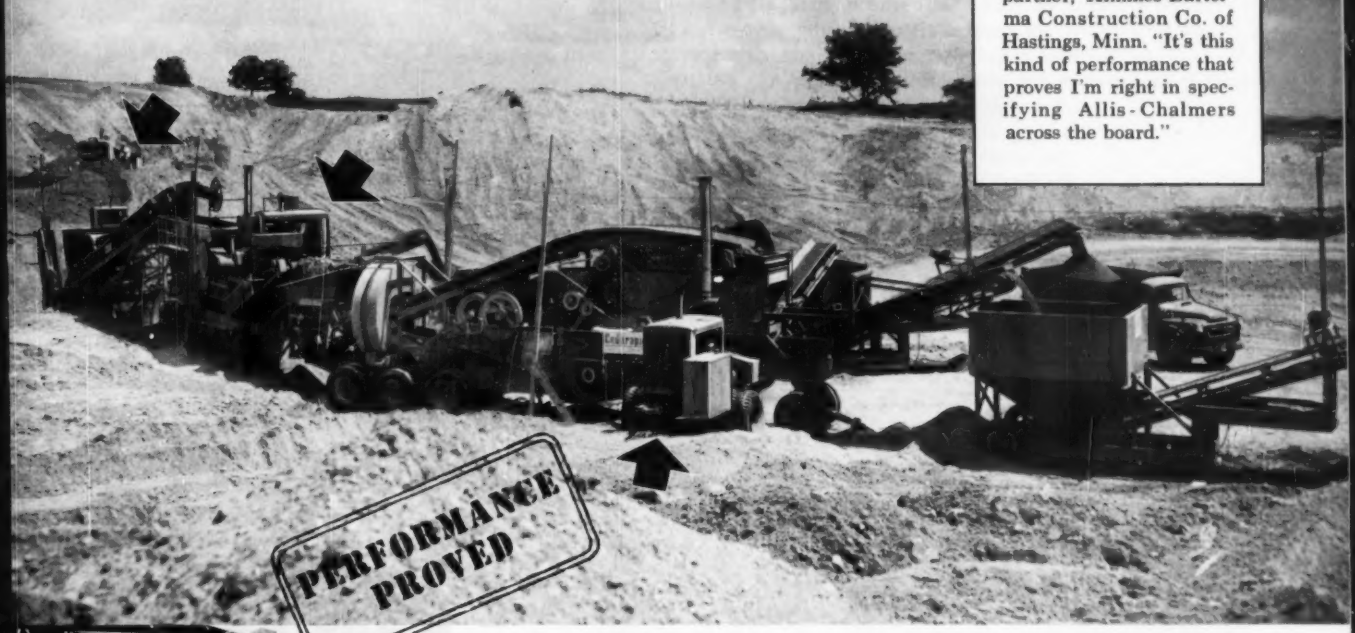
DIESEL PASSENGER CARS DEBUT

Automobile manufacturers in both England and Japan have introduced diesel models for private use. Japan's entry will have a 40-hp engine in a Toyota Crown de Luxe chassis and body. Price delivered is expected to be about $2500. English diesel, out of Standard-Triumph, is a version of the Ensign. It is available with a Perkins "Four 99", 43 bhp at 4000 rpm. Both cars are claimed to give excellent fuel economy, should be worth watching for both owner reaction and performance.

MORE INDUSTRY NEWS FOLLOWS ►

"Our 16000 and 21000 diesels have plenty of reserve power, with economy and dependability to boot,"

says S. T. Kimmes, partner, Kimmes-Bartelma Construction Co. of Hastings, Minn. "It's this kind of performance that proves I'm right in specifying Allis-Chalmers across the board."



An HD-16 tractor, powered by a 16000 diesel, pushes sand and gravel to the crushers—these crushers are also driven by 16000 and 21000 diesels.

A 16000 diesel powers this hopper at the pug mill.

21000 — 340 hp
(turbocharged)
16000 — 230 hp

Supplying and placing more than a million tons of subbase material for runways at a new midwestern Air Force base is typical of the jobs handled by the Kimmes-Bartelma Construction Co., Hastings, Minnesota.

Kimmes' aggregate plant shown above turned out 8,000 tons per day. These Allis-Chalmers 16000 and 21000 engines logged over 1,500 hours in three months. The only downtime on this job was due to wet weather.

Why is Kimmes' operation Allis-Chalmers-powered all the way? Because as he puts it: "These engines are in there giving us real performance day in and day out with no strain — in the tractors, on the crushers, and at the pug mill." They deliver the power and torque they are supposed to without overworking. The completely new Allis-Chalmers open-chamber combustion system makes the 16000 and 21000 the most economical, cleanest-running, fastest-starting diesels in their class.

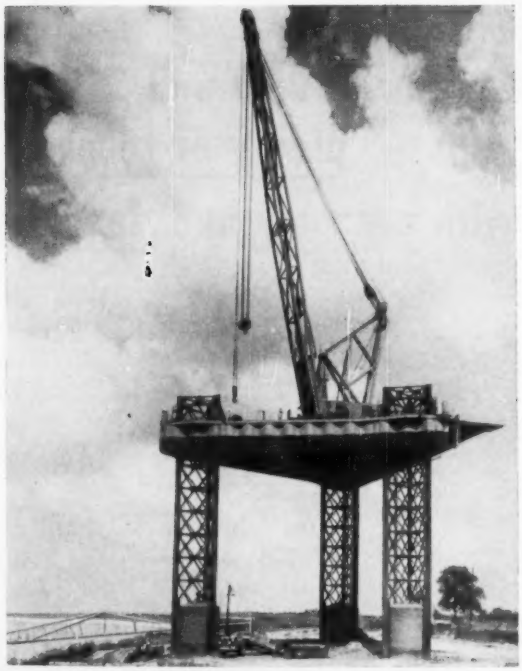
Let your Allis-Chalmers dealer tell you more. Let him refer you to users — find out what they think of these "Performance-Proved" engines. Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

POWER **FOR A GROWING WORLD**

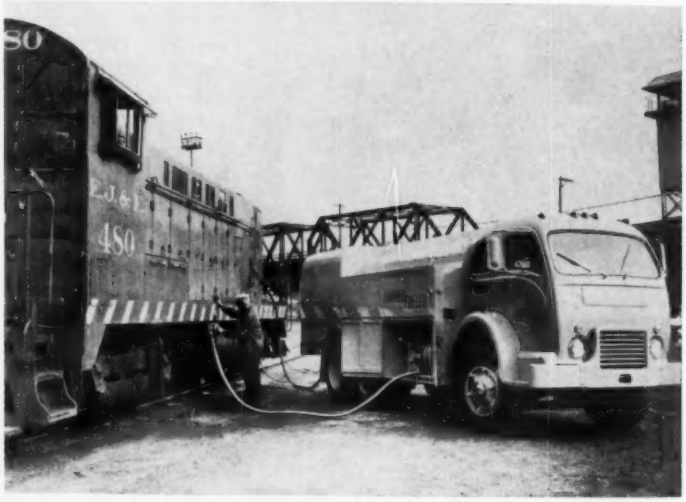
BC-23

diesel power news section



This 2000-ton electric bridge building platform, built by R. G. LeTourneau, Inc. will be used to build a six-mile bridge across Lake Maracaibo, Venezuela. Power for the giant crane mounted on the platform comes from a battery of Cummins' diesels adding up to 1200-hp. It is similar in design and construction to the mobile off-shore oil drilling platforms the firm has built for use in the Gulf of Mexico. Revolutionary "lake-walking" bridge builder has a self-leveling device which insures a stable and level work floor. This will permit work to continue regardless of weather conditions on the lake.

International Harvester's Melrose Technical Institute, a pioneer program in the training of service personnel, continues its fine educational work. Technician awards were made recently to 52 mechanics of Allied Equipment Co., Fresno, California. Service manager for Allied, E. A. Smith, second from left, flanked by IH service representatives receives a top rating Service Technician's diploma as Allied executives look on.



White 3000 Series hydraulic-tilt-cab trucks with "Farrell Fueler" units provide complete fuel, sand, water and lube oil servicing of diesel locomotives at yard or road locations. Potential of this application is elimination of the inflexibility of central point servicing; a vital factor in the economy of many railroad operations. Farrell Fueler has a capacity of 1500-gal of fuel, 70-cu ft of sand, 80-gal of radiator water and 90-gal of lube, compressor and engine oil.

NEWS ABOUT PLACES, PEOPLE AND PLANTS FOLLOWS ►

Stewart & Stevenson To Build 300 Diesel-Generator Units for PFE Refrigerator Cars

The Pacific Fruit Express Company has selected Stewart & Stevenson to provide 300 diesel-generator units to produce electric power for the operation of refrigerant equipment on 300 new Pacific Fruit Express cars.

Stewart & Stevenson units will be designed to operate 21 days unattended. This will be assured in all weather conditions by an automatic control system designed by Stewart & Stevenson. This Houston firm has had wide experience in application of diesel-driven generator sets for service in extreme environmental conditions.

Work of the PFE units will begin sometime early in 1960, depending on the availability of steel.

Henschel to Market Diesel-Hydraulic Locomotive Engines in United States

Through its American representative, Norca Machinery Corporation, Henschel-Werke is marketing a line of "explosion-proof" diesel-hydraulic locomotives. Designed for use in refineries, chemical plants and mines, here are some of the features claimed for these locomotives. Exhaust gas temperature is regulated by means of water injection into the exhaust pipe and a thermostatically-controlled shut-down valve which operates when exhaust temperature exceeds 320°F. Another valve shuts down the engine when its speed goes below a pre-set minimum, giving protection in case an explosive element is drawn into the air-intake. Electrical equipment is equally well protected.

Engines for these locomotives are rated up to 500 hp in both naturally-aspirated and supercharged and 12-cyl in-line models. Smaller units use Voith hydraulic-mechanical transmissions, originally designed for trucks. Larger units use Voith transmissions made up of hydraulic torque converters and two hydraulic couplings, or other combinations automatically engaged depending on engine speed and tractive power required.

Henschel points to the interchangeability of parts as an important feature of these engines.

Cummins Has New International Service Organization

Cummins international operations has a new service organization which will direct all Cummins service activities outside of U.S. and Canada. A staff of service representatives has been named to provide technical training, support Cummins dealers, and work with operators on the uses and service procedures for Cummins engines throughout the free world.

End result of this program will be to assure users of maximum performance and availability.

Correction

In last month's issue of Diesel Power, on page 43 we published an item on Letourneau-Westinghouse's "Goer." This off-highway military vehicle is powered by a GM V8 diesel rather than a Cummins engine as we erroneously reported.

Naturally we regret a mistake of this kind and wish to assure all of the writers who called it to our attention that the error was made inadvertently. In such cases the printed word is like a bullet — you can't take it back. Our apologies to all.

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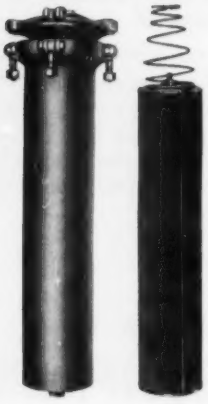

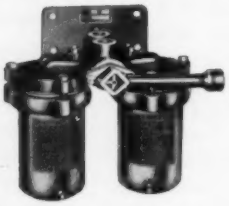

Fig. 1555BF Duplex Filter uses factory packaged laminated fiber disc filtering elements. Each filter comprising duplex operates independently or in parallel. Wide range of sizes.

Fig. 1576 Bag-Type Pressure Filters feature inexpensive, completely disposable filter cartridges. For filtering fuel oil, lubricating oil and wide variety of fluids.

AT LEFT: Fig. 1555-4L Filter and laminated disc cartridge. High flow rate; low pressure drop. Excellent micronic efficiency. Cartridges interchangeable with all other Nugent Bag or Depth Type cartridges.

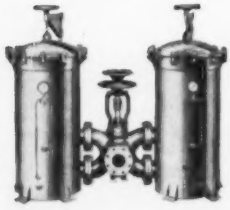

Fig. 1554AN-4L7 Duplex Strainers provide the advantage of uninterrupted flow, without by-passing, while cleaning the strainer baskets. Each strainer comprising duplex uses 7 strainer baskets Fig. 1554A-4L.

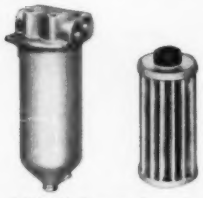

Fig. 1490AM-0 star-shaped extended area strainers offer increased free screen area over round basket type.

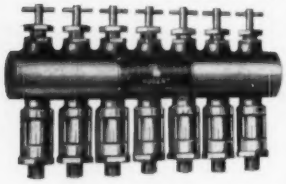

Fig. 1503F Multiple Pressure Oilers are available with from 2 to 24 feeds.

Fig. 524 Sight Feed Valves with removable glass. ¼" to ¾" IPS.

Fig. 1575 Pressure Sight Flow Lubricator. Single units or multiples to 15.

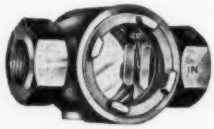

Fig. 1366E Sight Flow Fittings for indicating flow of liquid in a pipe line. Available in brass, cast iron, steel or stainless steel.

Valuable equipment deserves the best possible protection that can be provided. Nugent offers a complete line of filters, strainers and lubrication specialties for this purpose. All are backed by the experience and know-how gained through solving industry's problems in this field for more than 60 years. For bulletins giving complete information on any or all Nugent products, call or write today.

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Mack Reports Sales and Earnings Up for Third Quarter

With net sales for the three months ending September 30 at $77,607,731 Mack Trucks reports a heavy volume of business. Net income after taxes for the quarter amounted to over $4 million. Sales for the first nine months of this year are approximately 22% above the same period for the previous year.

Forecast at Mack is for continued increases over the coming months. With its expansion program getting under way Mack will be making news in many of the fields for which they make equipment.

Enterprise Honors Sales and Service Engineers

Sales and service engineers of the Enterprise Engine and Machinery Company, a General Metals sales subsidiary were honored at the recent general sales meeting. The week long conference was held at the Castlewood Country Club in Pleasanton, California

Mr. Austin Crouchley, N. Y. Branch Manager, was honored for having achieved the highest sales volume. Mr. C. Wilson of Power Equipment Co., Enterprise Kansas City distributor, and Mr. Dave Bain, Enterprise service engineer received awards for making the best contributions to the success of the conference.

Army and Air Force Programs Assign Officers to P-I-E Duty

As part of continuing program to strengthen national defense, an officer from the Army, and one from the Air Force will study the methods and operations of civilian trucking first hand.

Assigned by the Army as part of its Industrial Mobilization Program, is Lt. Col. A. B. Joyner, Jr. He is the eighth officer from the Army to work with P-I-E in this capacity.

From the Air Force, Major E. B. Arnn is the first assigned under the Industry-In-Training Program of the Air University's Institute of Technology.

Both men will work in all phases of the interstate motor freight carrier's operations. Their assignment will continue for about one year.

Executive Appointments At AiResearch

Industrial Engine Division of AiResearch has a new sales manager, Mr. James Hardy. Also announced, the appointment of Mr. Jack Wright as assistant manager of the division, and Mr. Jack Marinick as controller.

Mr. Hardy joined AiResearch two months ago as assistant to the division manager. He was previously with Schwitzer Corp. where his last position was executive engineer. Hardy succeeds George Bransom who has transferred to the Garrett Corp. sales staff.

Innes New Director of PR for EMD

Robert D. Innes has succeeded Volney B. Fowler, who died on October 6th., as director of public relations for Electro-Motive Division of General Motors. Mr. Innes was formerly assistant director of public relations. He has been with the firm since 1949. Prior to that Mr. Innes was active as a newspaperman in the Chicago area.

New GM Diesel Assistant General Sales Managers

Lauren H. Wells and Raymond F. Prussing have been appointed assistant general sales managers at the Detroit Diesel Engine Division of General Motors.

Mr. Wells will be in charge of home office staff activities and Mr. Prussing, field activities. The company reports that both are new positions created because of the Division's expanded diesel engine sales volume. Both men move up from within the company.

Robert W. Nelson Memorial Award Announced by American Air Filter

The Robert W. Nelson memorial award is being instituted to recognize outstanding young field sales engineers. Members of Mr. Nelson's family have made this possible in memory of the former vice president of AAF.

The award will be given each year to the young field sales engineer who is "adjudged as having best combined initiative, product knowl-

(*Continued on page 43*)

NOTHING ELSE CLEANS BARGES

LIKE LIX CLEANERS!

1/4 THE TIME, 1/2 THE COST!

Whatever the barge-cleaning job, there's a LIX Cleaner that will cut the time and cost 'way down. Lix **soaks** away all grease, oil and grime with absolute thoroughness and amazing speed... no scraping or brushing necessary Yet with this exceptional efficiency, Lix is SAFE — low in toxicity, not a fire hazard. Because they cut cleaning time to a fraction, Lix Cleaners are far more economical than "less expensive" cleaners.

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For Testing all Unit Injectors in One Fixture. Makes Plunger and Bushing Tests on all General Motors Unit Injectors.

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KIENE CONNECTOR NUTS — For convenient Attachment of Equipment to Test Stand or Test Pump. All sizes Connectors available.

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An entirely new and different product for the Diesel Industry offering features never before available in the field of Injection and Hydraulic repair and Servicing tools. Kiene Injector Test Stand and Hydraulic Pump give you all operating advantages of existing tools in addition to introducing many new and exclusive features. Kiene Products are Portable, Light Weight Compact, Rugged and Revolutionary in Design. They are engineered to give the Field Service Man adequate tools for on the job diagnosis and quick repair of valuable Diesel Equipment.

SAVE MONEY — SAVE DOWN TIME

Write for Bulletins KTP-50 and UTS-10

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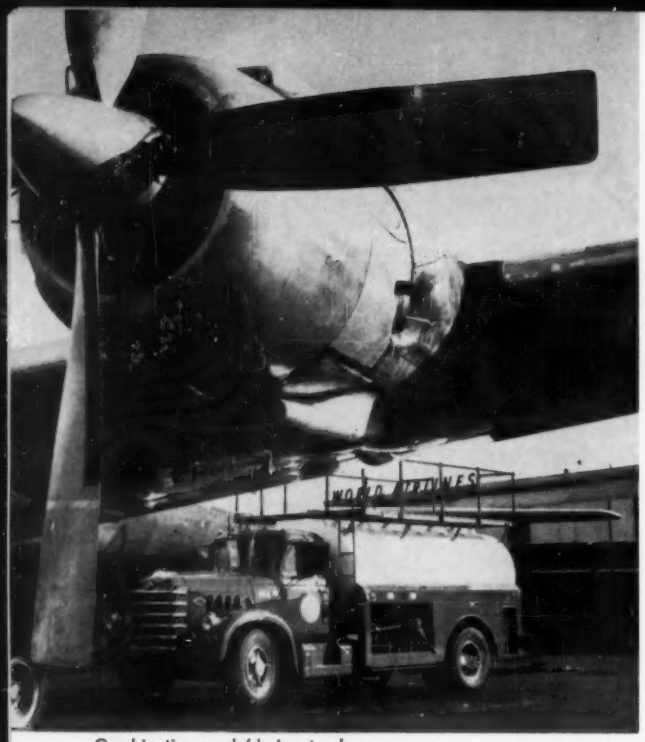


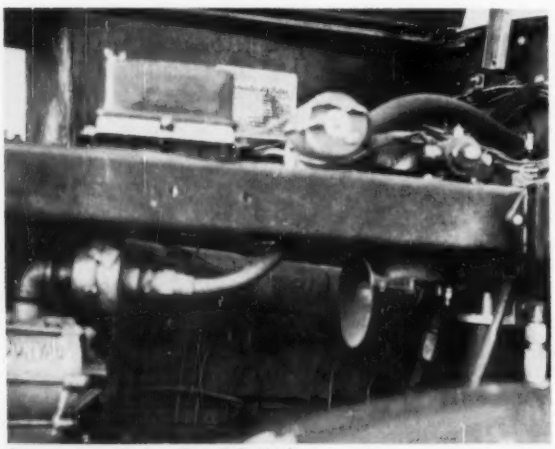
Combination wash/de-ice truck goes to the planes. Longest trip would be about three miles.

Shortest of Short-Haul Diesel Trucks

this wash truck has only clocked 1212 miles for Pan American, but its paying off in high availability and in providing dependable service to aircraft.

A cold wind blew a hint of winter across the flat expanse of Idlewild International Airport. The airline service people had already finished buttoning up the last of their cold weather preparations. A part of this procedure had been the conversion of a diesel-powered wash truck to de-icing.

With Jack Cullen of the Cummins Engine Company and Bart Darress, foreman service shops for Pan American, we bucked the wind across a service apron to have a look at what Cullen had told us was one of the shortest short-haul operations in captivity.



Compact, easily installed J6B 100-hp Cummins diesel utilizes Diamond T air cleaner, has required only routine servicing in six months of operation.

The clean, freshly painted Diamond T model 633 stood in a row of parked vehicles. "The engine is a Cummins J6B rated 100 hp at 1800 rpm. It was installed as original equipment. Let Bart tell you about the operation," Jack Cullen said.

"We needed a portable washing setup. Previously, the planes had to come to the washing machines in the hanger. This wasn't always practical. Now, this truck can go to the planes just about anywhere on the field. You're interested in the diesel power, so let's go into that first," Darress said.

The diesel idea started a couple of years ago. Through Jack Cullen, Pan American had arranged to try a diesel in a J-4 100 amp ground support unit. Gasoline engines in such units were proving poor for this service. These units stand out in all kinds of weather, often not getting regular daily use, then working for long hours at a time. This routine is tough on any engine.

Diesel dependability really came home here with a bang. The trial unit went to work and was still going strong when it was pulled out to go back to the factory for a check. After 3600 hours of service, wear was found to be negligible.

When it came time to work out the wash truck installation, it was natural that diesel got the nod. The work cycle for this vehicle is just as tough as it is for the ground support equipment. In washing it might run for 12 hours at a stretch. Then, it could sit idle for a day or two. So the demand was for dependability. When it was needed, it had to be there. You just don't keep a few million dollars worth of airplane standing around waiting for a broken down wash truck.

High availability of aircraft is an extremely important factor in airline operations. Support equipment, in turn, must be available to provide vital power or services. De-icing equipment better be ready to go to work when it

Bart Darress and Jack Cullen beside Pan American's diesel ground service unit . . . a unique application of diesel power.

is needed. Dependability is again, the principal basic requirement.

"We fuel this rig about once every two weeks. We're using Socony 158, the same as in our jets. As you can see from the mileage indicator, travel is a small factor. She has only gone 1212 miles in the six months in operations. The longest run she might make would be about three miles. Its the hours of operation that tell the story. Check the meter, she reads 760 hours.

"Aside from normal servicing, there hasn't been a maintenance item yet as far as the engine goes. As you can see, its a nice neat installation. As a matter of fact, the engine looks pretty small in this body.

"The tank was installed by a local outfit. It is divided into four sections. This gives us the capability of mixing washing solutions to just the formulation we want. There are two Marlow pumps, one for washing and one for rinsing. Both these are driven off the diesel. Of course, she's all full of de-icing solution now," Darress told us.

A second truck of similar specifications is on order. This unit will be a cab-over design with the same engine, the Cummins J6B. It will do a third job, additional to the washing and de-icing. With the mounting of a "cherry picker" boom it will be used to change light bulbs in the vast, high hangars.

As unlikely as these jobs sound for diesel power, the proof of the installation lies in the high availability of such diesel powered equipment.

"I sell these engines," Jack Cullen says. "I see them in all kinds of applications. That's one thing that makes this an exciting business, watching diesels prove out in so many new and different applications.

"This installation at Pan American is an excellent example of what the diesel can do in short-haul, stop-and-go service. It is also an example of the point that fuel economy is not the only sales feature of the diesel. Where ever other diesel capabilities, and dependability are demanded, we can sell engines. And you've seen, with an airline, that dependability can be a must.

"This is true in many other services. It points to another aspect of economy, one that helps to narrow down the premium for the diesel.

As in the case of the ground support units, the additional investment really pays off. It is on the job when you need it, and it outlives two gasoline engines, requiring far less maintenance all along the way. On the surface, the combination wash, de-ice and high access truck seems to be very light service for the diesel. But there it is, doing a job and paying off in high availability and long life."

There is a last point to this story, one that Jack Cullen proves, himself. Applications are where you find them. The aggressive salesman, who knows what his line of engines can do, finds new applications, opening new markets for diesel power, economy and dependability.

SCHOOL BUSES— a potential diesel market?

"The State of North Carolina is interested in maintaining and improving its already excellent record for high achievement in the field of safety and low cost with regard to school transportation.

"Safety and low operating cost are known to be outstanding characteristics of diesel engines. For this reason we have made available one of our school buses for installation of a Cerlist Model 3 diesel engine.

"Because of its light weight, small size and high speed range, this engine lends itself to replacement of gasoline engines in our school buses without alteration of the engine compartment or change in gear ratios.

"Reports we have received on the operation of the I-H 67-passenger school bus powered by the Cerlist diesel are very interesting with regard to both markedly improved fuel consumption and low maintenance potential.

"Road performance is reported to be fully comparable with regard to both acceleration and pulling power to the 240-cu in. gasoline engine replaced.

"We plan to study this installation carefully to determine the feasibility of further conversion to this diesel among the 8250 school buses operated by the State of North Carolina."

(Statement of Mr. C. C. Brown, Director of the Division of Transportation for the North Carolina Board of Education.)

IN the "they said it couldn't be done" department is Cerlist's successful installation of a diesel in a school bus. This service appears on the surface to be one of the most unlikely fields for diesel penetration because of the low usage factor and limited annual mileage. All the more credit to Cerlist for tackling it. Of course one installation does not constitute a trend or prove a potential market but let's take a closer look; could be a sleeper.

Right now, better than a third of our growing population of school children is picked up and delivered in school buses. Both the number of children and the percentage of total enrollment carried is growing steadily.

Figures issued by the Office of Education, U. S. Dept. of Health, Education and Welfare for the 1956-57 school years gives total school buses at 145,917. By this time there are at least 150,000 to 155,000 units in operation. Definite figures are hard to find as school buses are usually lumped with other "non-revenue" types.

Similiarly, while just under 20,000 new school bus chassis were produced in 1958, a considerable number went into other uses. Yet even a conservative figure of half or 10,000 new units represents an attractive original market and adds substantially to an already sizable potential aftermarket.

Why Diesel school buses . . .

Obviously, the first reason for considering diesels for this service is possibility of reducing overall costs. School bus operation is primarily at public expense and is part of the pattern of rising educational costs. Any reduction or even just holding the price line is attractive.

A second factor, and an important one where peoples' kids are concerned, is the element of safety introduced by use of low-volatility fuel. Being absolutely objective, this factor is probably more emotional than factual as kids spend a lot more of their riding time in cars. Yet the point is that either public or private owners can point to this extra measure of safety when entrusted with care of others' children. For private owners, it could tip a contract in their favor.

Getting back to operational costs, let's look at the facts. There's no question that the diesel can cut fuel and maintenance costs but will the savings be enough to amortize

(*Continued on page* 41)

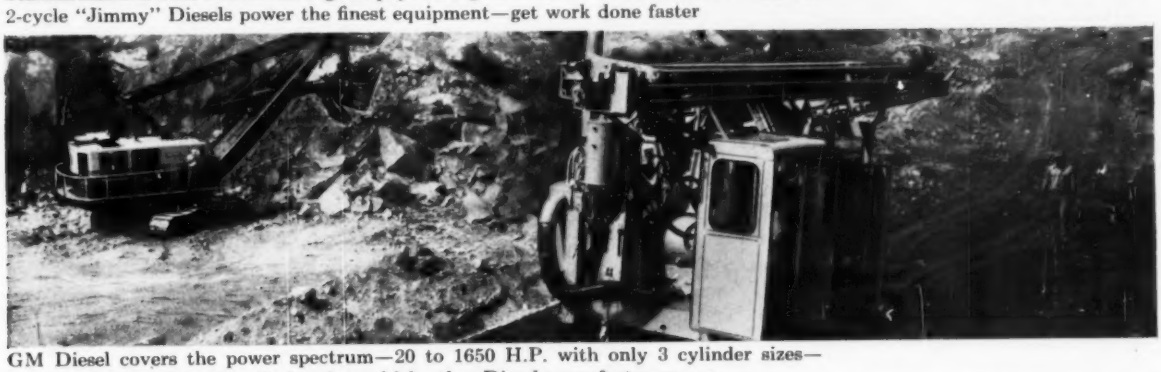
NOW YOU CAN STANDARDIZE WITH THE

all purpose power line

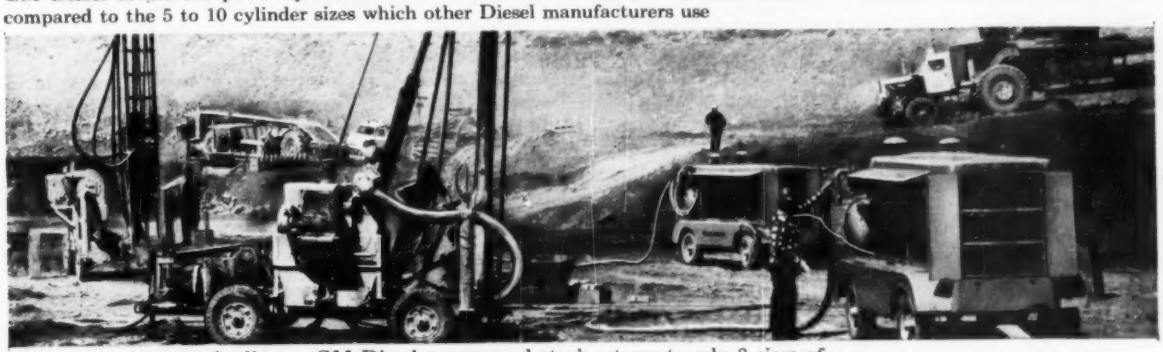
(20 TO 1650 H.P. IN ONLY 3 CYLINDER SIZES)

...and get all the benefits of GM Diesel standardization in any type of equipment built by over 250 leading manufacturers

Standardization with GM Diesel engines pays off big for contractors because fast-stepping, 2-cycle "Jimmy" Diesels power the finest equipment—get work done faster



GM Diesel covers the power spectrum—20 to 1650 H.P. with only 3 cylinder sizes—compared to the 5 to 10 cylinder sizes which other Diesel manufacturers use



Contractors who standardize on GM Diesel power need stock, at most, only 3 sizes of wearing parts—maintain full protection with the smallest investment in spares

GM DIESEL

PARTS AND SERVICE WORLDWIDE

DETROIT DIESEL ENGINE DIVISION, GENERAL MOTORS, DETROIT 28, MICH.

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario

Today's Diesel Man

"Maintenance and fuel costs are the big factors. We keep our diesels running and they keep our fuel costs down. In this business, you either watch your economy, and keep your operation tight, or you don't stay in business."

S. T. Kimmes
Kimmes-Bartelma Construction Company
Hastings, Minnesota

THE Kimmes-Bartelma Construction Company, Inc., is owned and operated by S. T. Kimmes and Charles Bartelma. Their headquarters is in Hastings, Minnesota. But more than likely, you won't find them there. You will find them at one of their job sites— and you'll find them hard at work.

S. T. Kimmes, who started the firm back in 1947, has been working in this business since. Then, he had three employees, one motor grader and a crawler tractor. Today he employs 200 people and has a multiplicity of equipment—the bulk of it diesel. He keeps up with his field through trade books and he belongs to the AGC.

Representative of today's diesel men, his qualifications are somewhat unique. Mr. Kimmes works on both the management and operational side of a diesel-powered industry. He selects and purchases the firm's diesel equipment. He supervises its maintenance. He puts it to work.

"Today, three are two key things you have to watch. The first is economy. Having all of our heavy equipment diesel-powered cuts way down on maintenance, halves our fuel bill. Matching the equipment to the job is equally important.

"Now that means a number of things. It works all the way back to selection of the right equipment, the right power to do the job. It means an efficient maintenance program, and it means careful management of the equipment on the site," Mr. Kimmes told us.

Let's take this business of economy first. Since "S. T.", as Kimmes is called by his friends, buys all of the equipment for the firm, plus seeing to it that it keeps running, he is in the cat-bird seat when it comes to proving out diesel economy and operational dependability. Let's look first at his equipment requirements and then at how this ties in with his operations.

"We buy most of our equipment from one distributor, Borchert-Ingersoll, Inc., the Allis-Chalmers' dealer in St. Paul, Minn. We have standardized on one line, and for good reasons. It adds to the overall economy of our business.

"First of all, we selected a line that we figured would give us the performance and power we needed. This means that we deal with one source for service and parts. We have found that because they get all of our business we get the best possible treatment from the local dealer. When we need something—we get it.

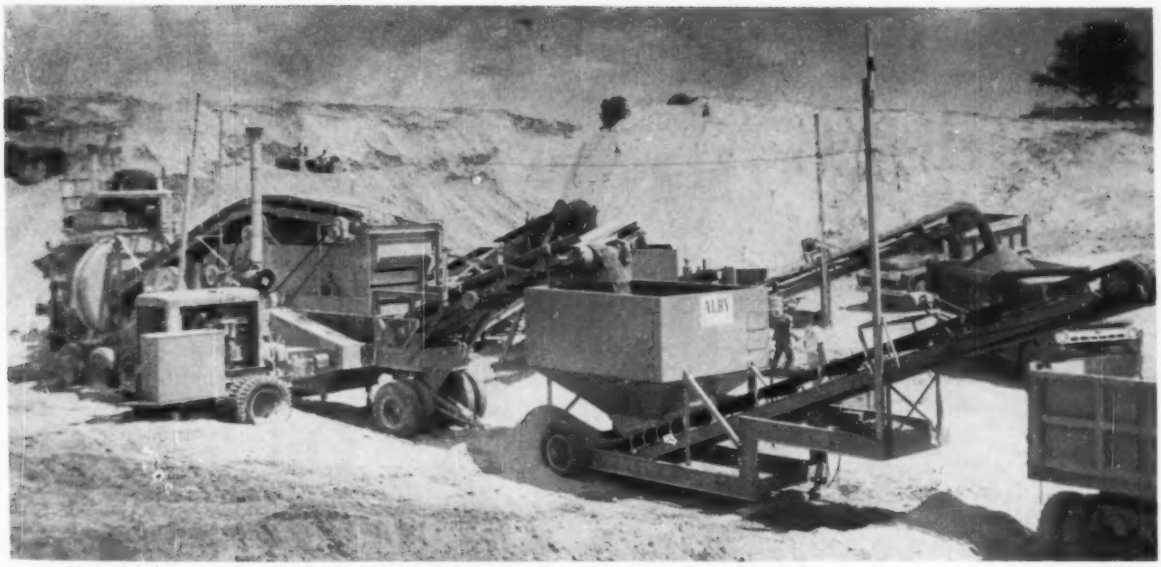
"Within our organization, this simplifies our maintenance work. One line means maximum parts interchangeability. For example, between the A-C 16,000 and 21,000 engines there is 95% interchangeability. We use these engines in crushing plants and they have done an excellent job in the 2000 hours they have been in service. Operations have been held up only once due to damp weather, which as you know affects the moisture content of the aggregate. This had nothing to do with the engines. They have proven to be dependable, economical-to-run power units.

"Through this standardization, our mechanics have had to become familiar with only one line of engines and parts. It makes the mechanical work that much easier, both in the field and in our main shop in Hastings.

"And there are other advantages. A good manufacturer stands behind his product. He has to. There are too many good engines in the field. You know what this kind of backing means when it comes to warranty," Kimmes told us.

On the job . . .

Currently, Kimmes is working on three gravel jobs



If one of the engines in this production line breaks down everything stops, from the crawler feeding the crusher to the trucks moving the load out to the job . . .

and seven bridge projects. Visiting one of the gravel sites proved out Kimmes two salients—economy and operational dependability.

A crawler tractor was dozing rock off a pile into a conveyor which fed to a secondary crusher. Another conveyor fed to a gravel surge bin. Sand was carried from both primary and secondary crushers by two side conveyors. This production line handled the work rapidly and the trucks moved steadily, carrying away the load.

All that was needed to stop production, however, was for one of the engines to go down. Everything then comes to a halt from the crawler clear through to the trucks delivering to the job. But Kimmes' diesels keep that line running. As the photographs show, this is a well planned, well maintained operation powered by good equipment—a combination of diesel power matched to the job.

Mr. Kimmes supervises the maintenance of the equipment. Field work is performed by a crew of mechanics. Major overhaul is done in the headquarters shop, usually during the winter months.

Where it counts . . .

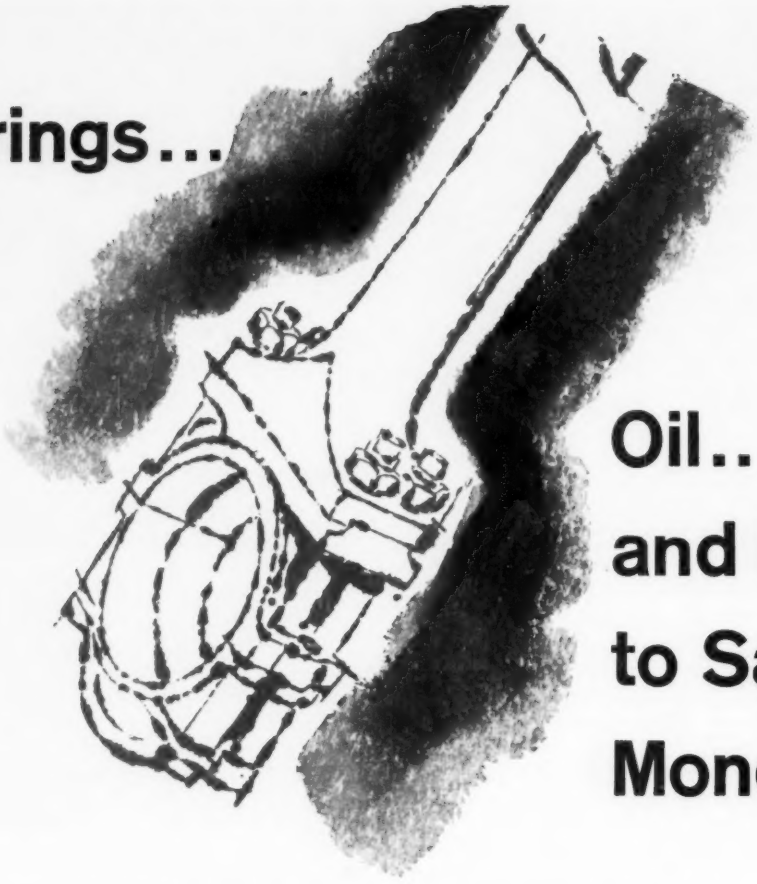
From the unique vantage point of both owner, equipment purchaser and supervisor, Mr. Kimmes knows the advantages of diesels as do few others. "You can't run anything else these days. When we find the right engine we'll probably repower a number of our trucks and get the economy of diesels in that phase of our operations as well," he said. "Diesels give it to you where it counts."

Allis-Chalmer's 16,000 powers hopper and conveyor at pug mill operation . . .

Secondary crusher is powered by A-C 21,000. Note high air intake and dual filters . . .

A-C D-344 40-kw generator set supplys power for Kimmes crushing plant . . .

Bearings...



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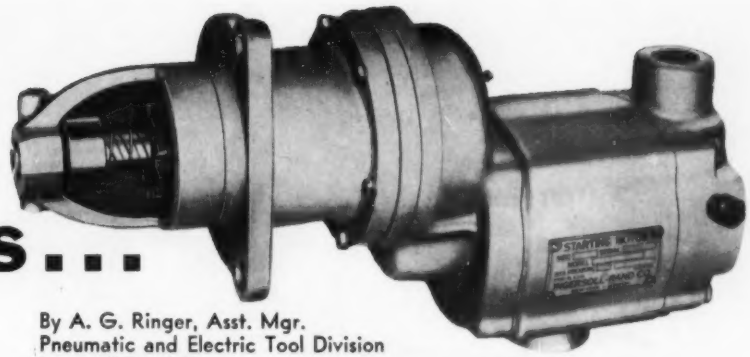
Starting with Air Motors . . .



By A. G. Ringer, Asst. Mgr.
Pneumatic and Electric Tool Division
Ingersoll-Rand Company

offers a reduction in weight and cost for trucks and other equipment with a source of compressed air.

AIR starting is becoming more popular for modern diesel trailer tractors. Reasons are found in two features—possible weight reduction and lower operating costs. Both are extremely important to today's carrier.

A good example of this is found in White's new lightweight 4400TDL diesel tractor. It shows how the truck manufacturer, engine builder and makers of components cooperate to produce an overall product meeting today's requirements.

Weight takes power, cuts payload . . .

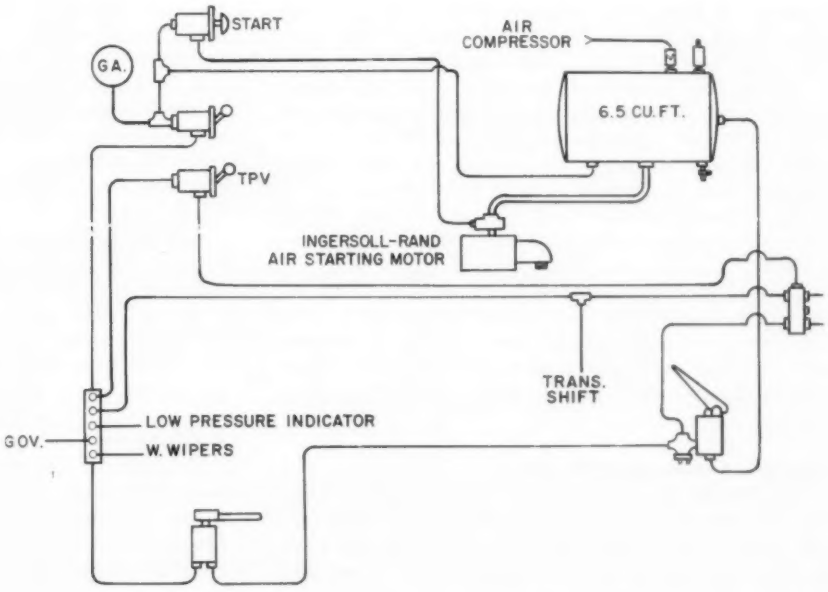
With present-day gross weight restrictions, every extra pound in the engine, tractor and accessory equipment means money out of the pocket of the carriers. White engineers have shown what can be done by stripping 1100-lb excess weight from the tractor by use of light metals and other materials in the chassis, body work, engine and accessories.

Aluminum parts were used on the engine wherever possible—flywheel housing, oil pan, gear case cover intake manifold and other parts. Choice of engine accessories, particularly the air starter, produced significant weight savings.

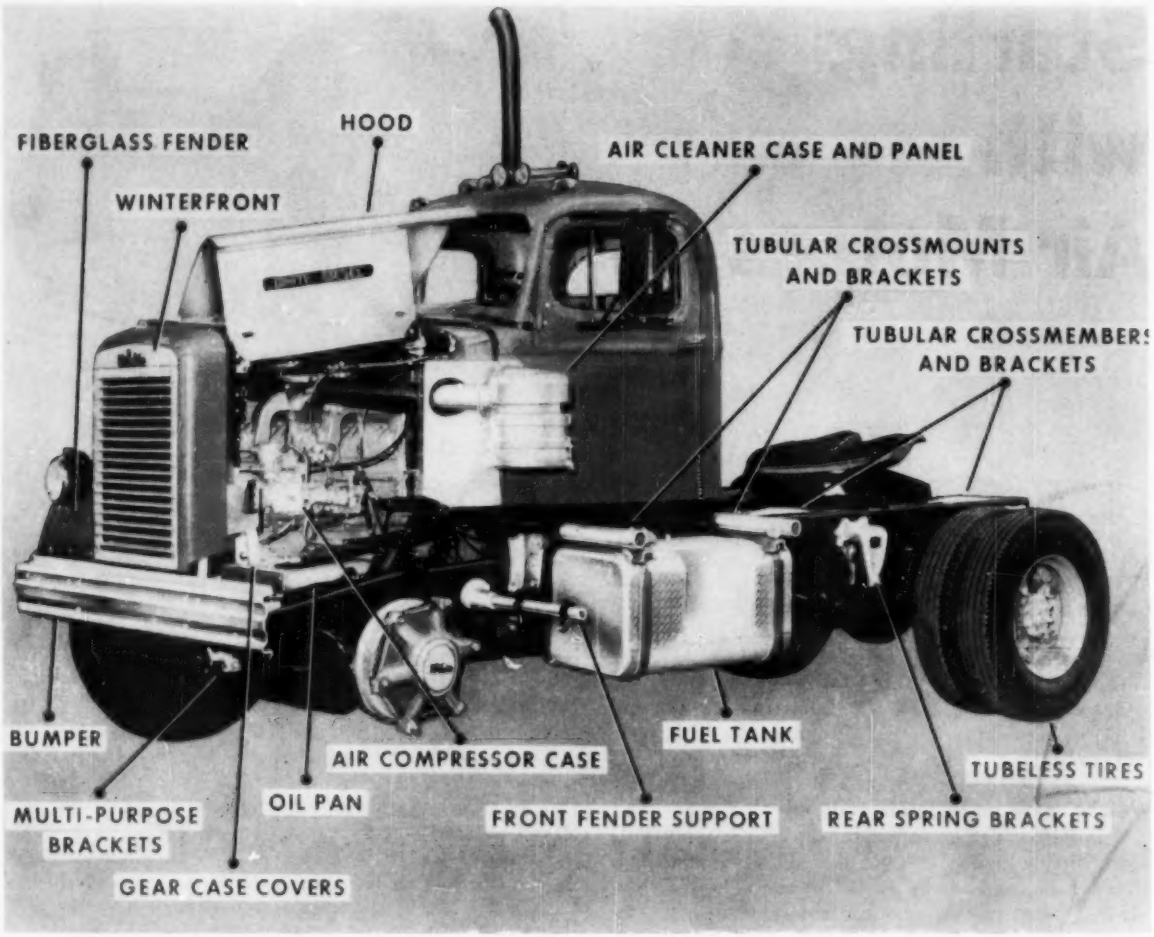
Using a multi-vane Ingersoll-Rand air starting motor, 211 lb or 19% of the total weight-saving was possible. The 10BM air starting motor accounts for a 20-lb saving with the remainder obtained through elimination of the high-capacity starting batteries and reduction in carrier weight.

In this case, four 60-amp hr batteries at 46 lb each and a 116-lb battery carrier are replaced with a single battery and a 15-lb carrier. A 58-lb aluminum air tank with 6½-cu ft capacity was added. Air valves weigh less than the conventional series-parallel switch.

Since such tractors have air brakes, they have an engine-driven air compressor. On the road, this compressor is running unloaded much of the time and is available to fill the starting air tank. The 1-R 10BM



Drawing shows integration of air starter into compressed air system of typical vehicular application.



White engineers stripped 1100 pounds of excess weight from this 4400 TDL diesel tractor. 211 pounds of this through the use of the Ingersoll-Rand air starter.

operates at 120-psi air pressure which produces better than 18 hp at the Bendix pinion speed of 2340 rpm. Maximum torque at these conditions is 71 ft lb.

Air required for three to five starts a day, the normal starting cycle, is easily made up by the brake compressor. The 10BM unit consumes about 11 cu ft of free air per start. Should the supply be depleted for any reason, another truck can run along side and recharge the receiver through a "glad hand." Or any service station can recharge the system through a tire valve on the receiver.

These comments show the practicability of the air starting system. Another operational feature can be added. High-speed cranking and faster starting is obtained at low temperatures. Freezing temperatures that greatly reduce storage battery efficiency have little effect on air starting.

Operating costs are reduced . . .

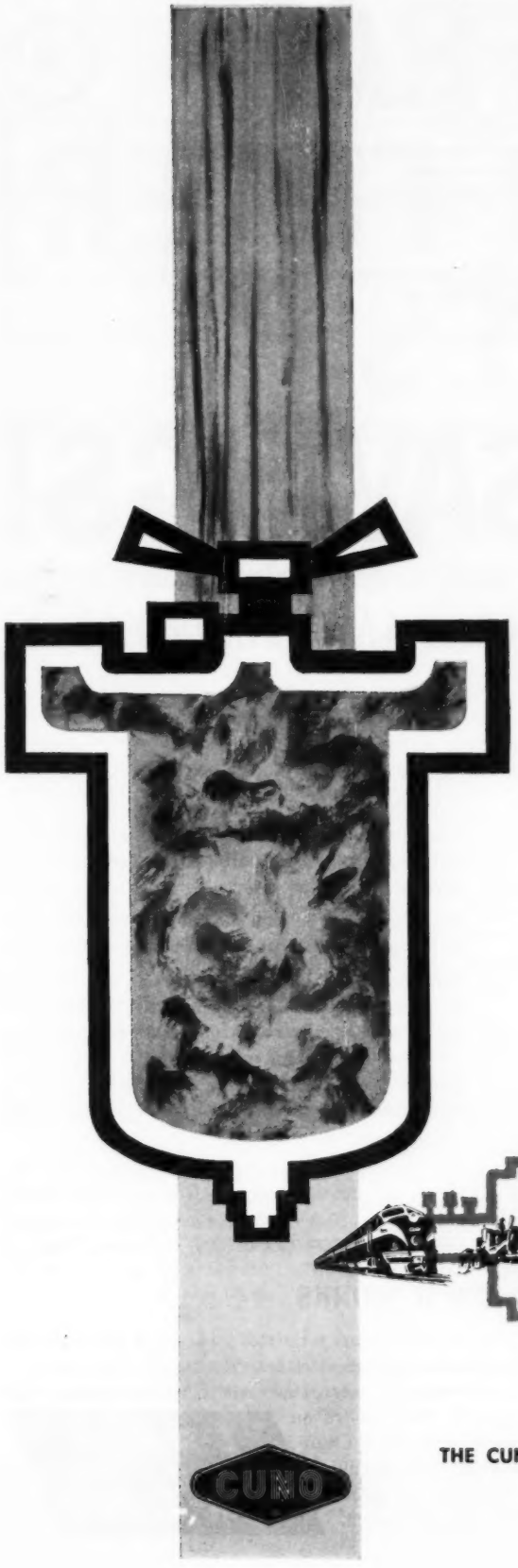
The simple fact of vehicle weight reduction means that the reduced combination weight can be hauled for less fuel. Or the weight reduction can be made up by revenue load and thus more hauled for the same fuel. However, simplicity of the air starting system leads to more direct savings.

Experience with air starting in the field indicates that cost of maintenance can be cut substantially. Records of trucking concerns show that greater ease of servicing the remaining simplified electrical system can reduce electrical maintenance as much as 70%. As for the starting system, records show the air-starting maintenance bill to be lower.

One freight carrier, running a fleet of well over a hundred 170-hp diesels, found its average electrical repair cost per tractor with electrical starting was $456.14 a year for parts and labor. Tractors equipped with I-R air starting systems averaged $11.50 for starter repairs, plus $72.80 for electrical repairs, a saving of $371.84 per tractor.

A strong case . . .

Possibility of weight reduction with its potential savings, plus direct maintenance cost reductions, make strong medicine. Strong enough to justify today's trend toward air starting systems in those applications where a suitable air supply is available.



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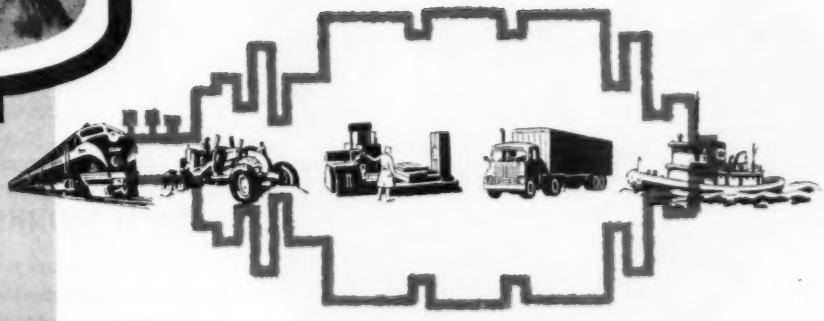

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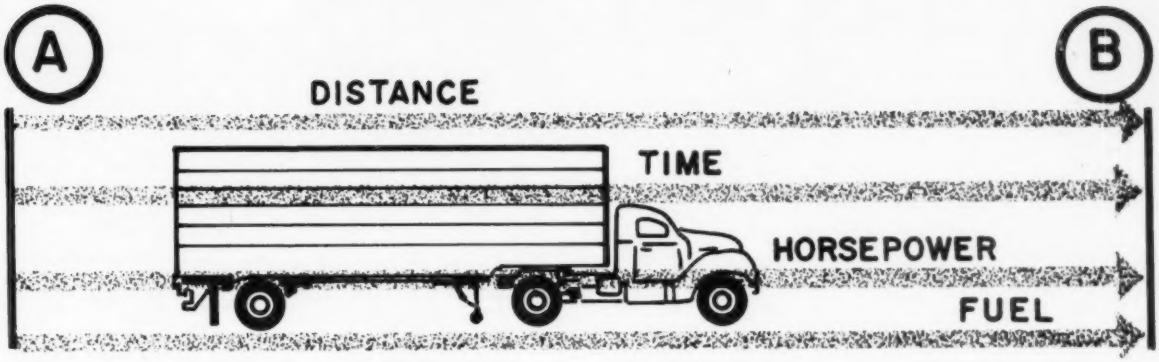


Effective application of high-speed engine turbocharging . . .

means analysis of your actual power requirements . . . consideration of the normal work cycle.

THERE has been some, shall we say, "disenchantment" with high-speed engine turbocharging. Note use of the word "some" because the bulk of these small turbochargers are doing a very creditable job, day-in, day-out. Modern turbochargers are mechanically tough and reams of factual evidence show them capable of doing what they are supposed to do—provide increased horsepower and improve specific fuel consumption.

Okay, so why any beefs? Here, you could ask the same question about any good make of naturally-aspirated engine. Why does one man get wonderful service and to another, the engine is a dog? Usually, you'll find the answers (barring the inevitable exceptions) not in the engine but in *the circumstances surrounding its use*. The same is true of turbocharged engines.

Turbochargers are a relatively cheap way to get more horsepower. They mean more power for a given engine size and weight, often an important consideration. Also, they are a means of reducing *specific fuel consumption*. There can be little argument here.

On the other hand, performance characteristics over a broad speed and load range are somewhat different for the turbocharged engine than for the naturally-aspirated engine or one with a mechanically-driven supercharger. Failure to recognize this and, where possible, compensate for it, has been one cause of dissatisfaction. This and some others will be discussed.

More power, more fuel . . .

More power for what? For a number of years we have had a surge toward higher horsepower that was more emotional than practical. Let's stop and think about it.

Consolidated Freightways started early with turbocharging to boost the power of their rigs. Later, they took the turbochargers off. Mr. E. B. Ogden, vice president, Equipment and Methods Development, gave an insight into the reasons in a paper presented to the SAE International West Coast Meeting in August.

Mr. Ogden assured his audience that he was not "anti-turbocharger-minded" and, in fact, commented that further turbocharger testing and evaluation was in progress. Yet the turbochargers had been taken off because they found that they added slightly to overall cost of operation. Here are some of Mr. Ogden's comments.

"Before any fleet operator decides upon turbocharged engines (or any other high-powered engine over and above about 200 to 220 hp, pulling loads in the 70,000-lb class), a study should be made to evaluate what extra horsepower is going to *buy* for him. If it can be justified by improved service necessary to hold business, by reduction in overtime paid to drivers or for any other reason that actually produces more profit for the company, then the operator should seriously consider increasing horsepower.

"With more power you could reasonably assume that you could traverse the route much faster. Herein lies the danger. Does it pay you to traverse the route any faster or does it just give drivers more time along the road at convenient coffee stops? What good does it do to have a vehicle into destination say at 6:00 am with a high-powered turbocharged engine as against probably 7:00 am with a naturally-aspirated engine if the vehicle is not to be worked until 8:00 am or 8:30 am?"

Mr. Ogden is questioning whether additional horsepower can be utilized efficiently. A good question because added power is generally taken out in performance at the expense of fuel economy. You never use more horsepower for free, whether the engine is turbocharged or naturally-aspirated. As Mr. Ogden cites in his paper, there is considerable difference in *specific fuel consumption* and *MPG*.

Engine builders give fuel consumption curves on the basis of specific fuel consumption in *pounds per brake horsepower-hour*. The reason is simple—it eliminates a

maximum number of variables. It takes into account the horsepower you are *actually taking out of the engine,* not its maximum rating, and also the time you are using this horsepower. Different lots of fuel, even of the same type, may have different weights per gallon and heat value is tied to weight. So BSFC compensates for differences in fuel energy.

BSFC curves are a good indication of an engine's efficiency and you'll find them lower for turbocharged engines, indicating improved fuel consumption. Miles per gallon is another story. This will vary with load, speed, grades, road conditions and, very important, how the rig is operated.

With more horsepower available, more horsepower-hours will be used to get from Point A to Point B. This means that while the turbocharged engine is using fuel at a lower rate per hp-hr, total hp-hr's is higher and so is the total fuel bill. So evaluate whether you actually need the extra horsepower and can make it pay.

Another approach can pay off . . .

So far, we've discussed over-powering as being one of the reasons for dissatisfaction with turbocharged performance. To avoid this and still get the advantages of turbocharging, why not provide her power that you actually need with a smaller turbocharged engine?

You'd have the right amount of power with no excess to be taken out in performance at the cost of additional fuel. You'd have the benefit of lower fuel consumption per bhp hr. And you'd certainly gain in weight and space.

What's the application . . .

Another area of dissatisfaction with turbocharged engine performance results from misapplication. Sometimes sales enthusiasm and aggressiveness and/or even unawareness that the turbocharged engine is not necessarily suited for all jobs or work cycles leads to an unsuccessful installation.

To the credit of turbo manufacturers and engine builders that use their product, they are pretty objective about this sort of thing. They don't want to misapply their product any more than you want to struggle with it. When consulted, they'll give you the straight dope. Yet occasionally misapplication occurs.

Usually, this is in equipment having a work cycle involving wide and rapid engine speed and load changes. Under such conditions it is difficult to get the full benefit of turbocharging because of the inherent lag in turbocharger response, particularly when rapid engine acceleration is needed.

Let's consider the problem from the viewpoint of one equipment builder. Here are comments by Charles J. Jacobus, chief engineer of the Trojan Division of Yale & Towne. His reference is to powering tractor shovels.

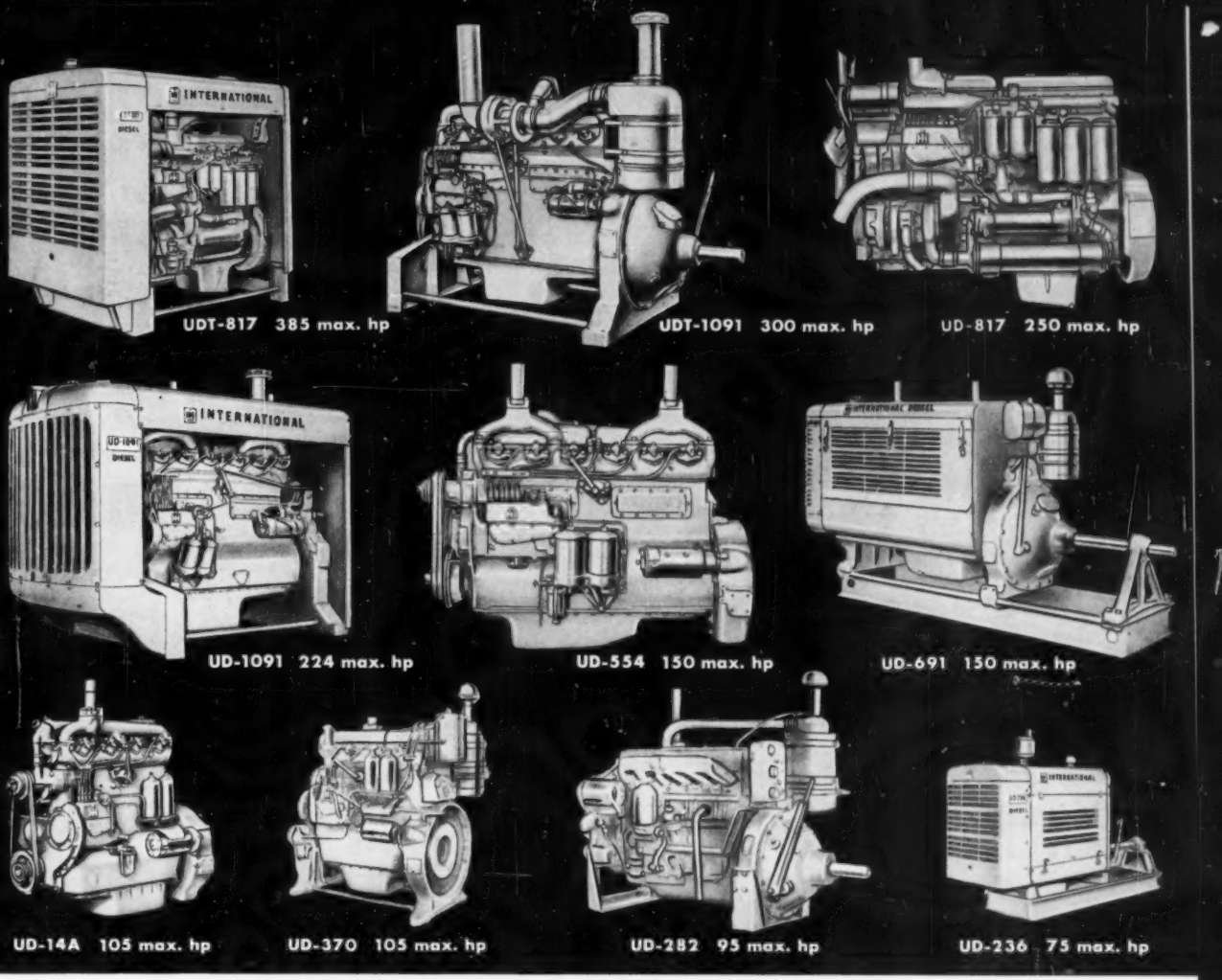
"A general tractor shovel loading cycle can be broken down into the following approximate time sequences: dig in pile, 5 seconds; back away, 6 seconds; turn and approach truck, 6 seconds; dump load, 3 seconds; back away from truck, 6 seconds; approach pile again, 6 seconds; thus completing the cycle. This hypothetical 32-sec cycle is quite representative with today's high-speed tractor shovels with power-shifted transmissions.

"Studying this operation we see that each time the tractor shovel reverses direction the engine goes from idle to full load and full speed. Each brief acceleration cycle is 6 to 7 seconds. Therefore for most efficiency and highest speed, it is important that we get full available power at an instant's notice.

"The engine must have a governor that reacts quickly to demand. We prefer an open-chamber diesel because they pick up the load more quickly. Differences in engine acceleration and ability to pick up load quickly is quite

(*Continued on page* 40)

Broad speed and load changes in 32-second work cycle in the Trojan 304 makes a naturally-aspirated engine most suitable according to their engineers.



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HMS makes good diesels better

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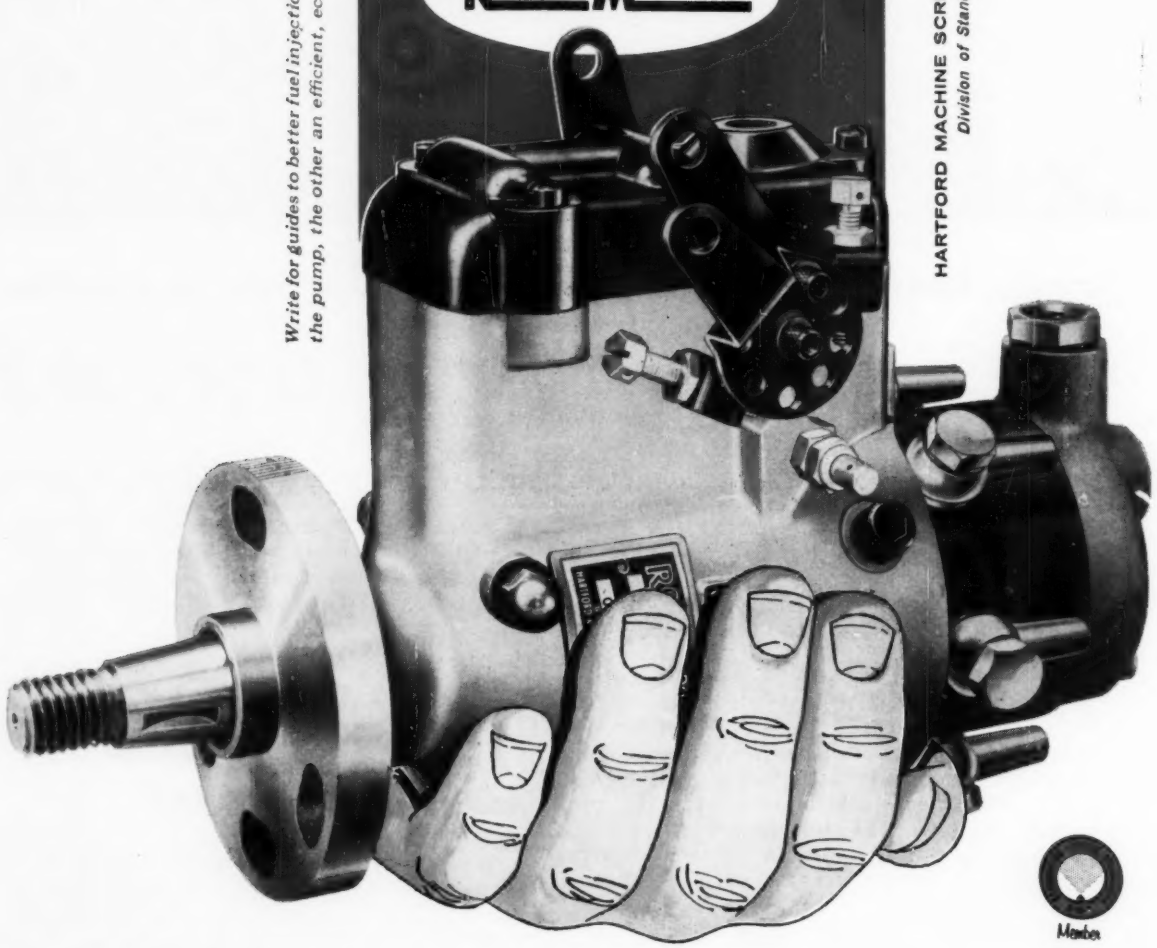

Write for guides to better fuel injection. One features the pump, the other an efficient, economical filter.

HARTFORD MACHINE SCREW CO., HARTFORD 2, CONN.
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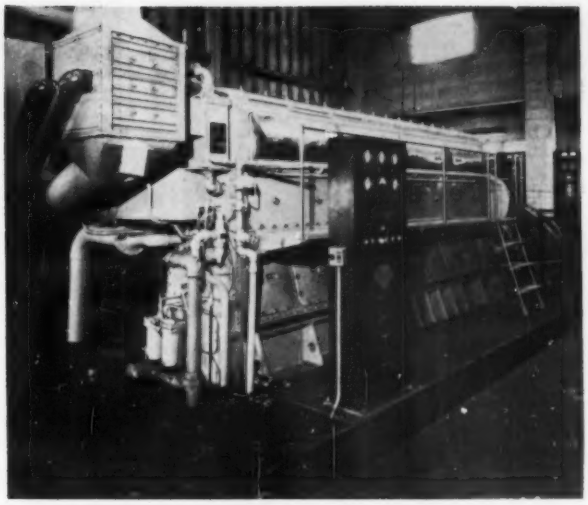
Member

Intercooler on White diesel low pressure turbocharging system shows strengthening ribs, transition ducting, water connections.



First, analyze conditions, then select the proper intercooler for performance, long-life and economy.

Want efficient intercooling?

INTERCOOLING increases the power potential of turbocharged engines. It provides the cylinders with a greater weight of air at a lower temperature. The greater weight of air permits more fuel to be burned with a proportionate increase in engine power.

Also, the lower temperature at the start of compression means that the average temperatures throughout the cycle will be lower. During periods of valve overlap, permitting blow-through, the cooler air can do a better job of cooling hot engine parts.

This turbocharger-intercooler combination is the main reason why modern engines can produce such high outputs and live comfortably with them. In the case of turbocharged natural gas engines, intercoolers (or aftercoolers, as some prefer to call them) permit high output without detonation to be maintained during high summer ambient temperatures.

Both 2- and 4-cycle turbocharged engines have benefitted through intercooling with considerable increases in horsepower. Just what happens?

What intercoolers do . . .

Net output of an internal combustion engine depends on the difference between the work obtained from expansion and what is put back in compression. Net output, therefore, depends on the efficiencies of compression and expansion. Small increases in these efficiencies will greatly increase output.

The greater the amount of air (in pounds per unit time) participating in the combustion process, the greater the potential engine output. This is where the turbocharger comes in. But the air compressed in the turbocharger is raised in temperature in proportion to its compression ratio. The function of the intercooler is to cool this air (air becomes more dense as it cools) so that a greater weight per unit of volume enters the cylinders.

In addition to supplying more weight of air, the effect on cycle temperatures and hot engine parts mentioned earlier is obtained. So there is no question of the desirability of intercooling. Why not intercool all turbocharged engines?

SYSTEM USED	MANIFOLD PRESSURE (PSIG)	AIR TEMPERATURE FROM TURBOCHARGER	AIR TEMPERATURE TO INLET MANIFOLD	ENGINE HORSEPOWER
Normally Aspirated	0	———	90° F	1000
Buchi (Non-intercooled)	5-6	160° F	160° F	1500
Buchi (Intercooled)	5-6	160° F	100° F	1620
Miller (Intercooled)	15	250° F	100° F	2000
Miller (Intercooled)	30	365° F	100° F	2320

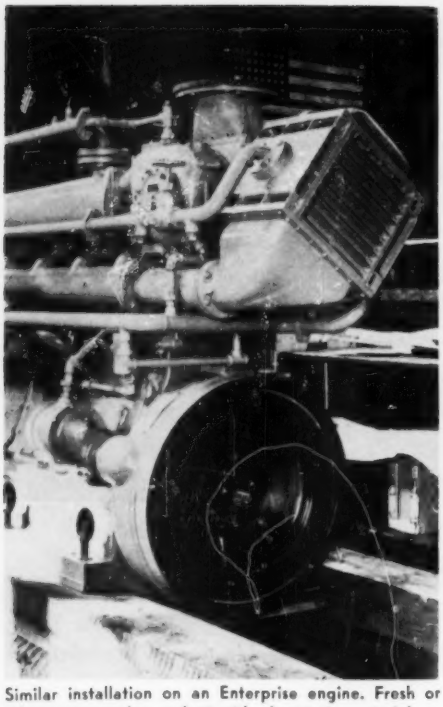
Intercooler application requires analysis . . .

No one intercooler design will suit all cases. There are too many variables to consider. The chart gives an example of some of these. It is a summary of characteristics for different turbocharging pressures, air temperatures from the turbocharger and to the inlet manifold, and horsepower derived. Figures were worked out using a hypothetical rating of 1000 hp for a naturally-aspirated 4-cyle engine as a base.

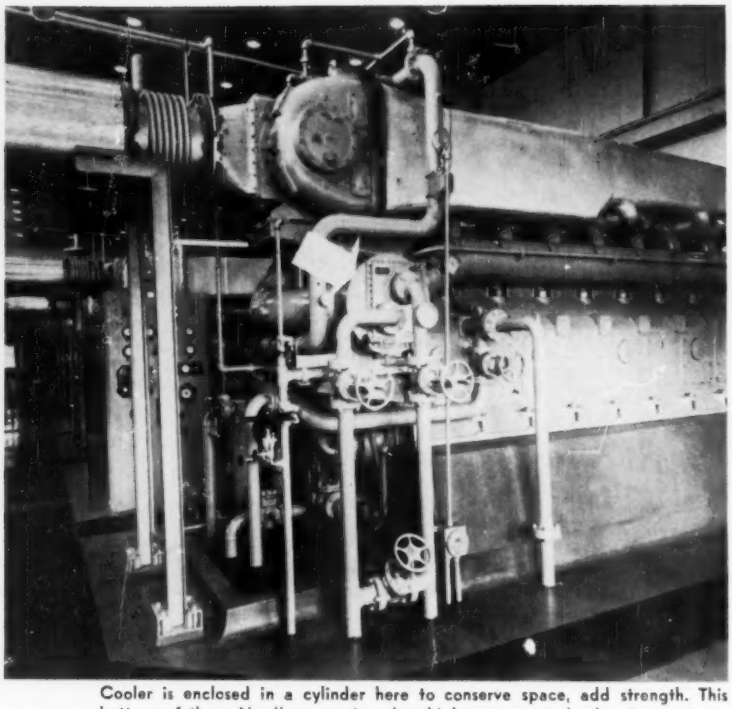
As manifold pressures increase, more air for a given engine is being handled. This affects intercooler size since flow restriction and velocities must be considered. Pressure is also important as it determines the loads on tubes and the overall structure.

As the spread of temperatures increases, more heat must be transferred. This will also affect intercooler size and to a degree, the type of construction used. Note that here intercooling is to 100°F. The degree of cooling will, of course, vary with the size and type of intercooler and the temperature of the cooling water available.

Air can economically be cooled to within 10°F of the cooling water temperature. In this case, 90°F water from



Similar installation on an Enterprise engine. Fresh or salt water can be coolant with change in materials.



Cooler is enclosed in a cylinder here to conserve space, add strength. This battery of three Nordberg engines has high pressure turbocharging systems.

a cooling tower or evaporative cooler was considered as available. Obviously, this is not always so and this explains why intercooling is not practical in some installations.

For example, in vehicles and stationary applications where a closed radiator-cooled jacket water system is used, only 160 to 185°F water would normally be available. Unless very high turbocharging pressures were being used, the water temperature might even exceed air temperature and so intercooling is no longer feasible or practical. Thus, availability of water at a suitable temperature for economic air cooling is a big factor to consider.

What type intercooler?

An intercooler is essentially a radiator having a heat transfer surface consisting of tubes and fins. Tube ends are rolled into a header plate to which is attached a tank. Core sides, either steel plates or castings, confine the air in its passage through the core and prevent recirculation.

The structure must withstand the expected internal water and air pressures. Core sides, for example, may need ribs or stiffeners. Remember that while air pressure may be only 8 psig, this is working on every square inch of the core sides. Units must be "beefed up" enough to prevent any deflection that could lead to air leakage past cooler gaskets or to other damage.

Several types of cores are available. For proper selection we must know the type of cooling water and expected water and air pressures.

The most efficient core available is the flat-tube type. However, it can be used only with fresh water and this should be free from large floating particles that might plug the tubes. Water pressures should not exceed 50 psig and air pressures, 10 psig.

Another efficient core used ⅜-in. diameter tubes with plate fins. This fin and tube arrangement permits use of higher operating pressures and temperatures. Also, it can be used with fresh water, brackish water, sea water and cooling tower water. Materials used, however, will vary with the type of water used.

For fresh water, tubes can be of either copper or red brass and fins can be aluminum or copper. The header and tank can be red brass or mild steel.

For salt or brackish water, materials can be varied depending whether or not military specifications prevail. When they don't inhibited Admiralty metal tubes, fins, tanks and headers are often used. Otherwise, a cupronickel material is used for tubes and headers, Admiralty for the fins and gun metal for the tank castings.

With muddy water such as encountered in river and harbor work, larger tubes are recommended, either of ⅝- or ¾-in. diameter. Materials used are generally those suitable for salt or brackish water. Either plate-type or spirally-wound fins are used.

In summary . . .

Intercoolers are an effective means of increasing output of turbocharged engines. They should be selected and applied after full consideration of all the circumstances surrounding the particular application. Get competent engineering help from heat transfer specialists. Don't forget, cost must be justified by results.

When preliminary analysis shows the feasibility of economic intercooling, be sure to get the right size and type of unit, built with suitable materials, for long-term, minimum-cost satisfaction.

Effective filtration of both fuel and lube oil combines to give long service life of both oil and filters.

Planning lube oil filtration

By John E. Whipple, Special Technical Representative, Fram Corp.

You should be considering the type of fuel and lube in selecting lubricating oil filtering media . . .

THERE'S more to filtration than just sticking a sock in a can. We're trying to keep the lube oil in good condition for as long as possible by taking out abrasives and deposit-forming materials. Also, this has to be done at a cost low enough to make it all worthwhile.

Many variables affect filtration. Naturally, different types of lube oil change the picture. It is less well understood that the type of fuel used affects not only fuel filtration but lube oil filtration as well. A good example of this is found in natural gas engines and dual-fuel units. When using gas for fuel, one change of lube oil cartridges may last for months, even a year or more before replacement. With liquid fuels, cartridge replacement would be necessary in a month or so.

After extensive testing of lube oil filters on diesels in actual use, a formula has been worked out whereby a lube oil filter may be recommended for a specific engine. Using the Filcron filter, adequate filtration will be provided for one month based on a given number of gallons of No. 2D fuel oil consumed in this period. Service life can then be predicted for actual fuel amounts by use of a constant.

Now, this formula is general in nature and applies to this one design of cartridge and No. 2D fuel. When you depart from these conditions, adjustment must be made. Unfortunately, there is no "book" solution to the problem of selection. Experience, backed up by laboratory tests, is the only way to get a satisfactory and economical answer. Get all the technically qualified help that you can.

There are some interesting things about filtration of lube oils and fuel oils. I would like to point out a few ideas based on data resulting from actual field tests.

Type of lube oil affect filtration . . .

Oils in use vary from straight mineral oils to the highly-compounded Series 3 product. Each type will have some effect on degree and quality of filtration even when the same fuel is used. For example, one type filter may easily hold the PEI (Petroleum Ether Insolubles. See Chart) down to 0.10% by volume for a given time when using straight mineral oil. Yet when a compounded oil is used, this same type filter may have difficulty holding the PEI in the oil down to 0.5% or even 1.00%.

An example of this is shown by a laboratory test made on the same lube oil but using two different types of our filters. Fuel was the same in both cases. Results are given before and after passing through a centrifuge and then a filter.

PEI (*Petroleum Ether Insolubles*) — Total solid contaminants in used oil not soluble in petroleum ether. These are normally combustion products (fuel soot, carbon and resins), abrasives (iron and/or other wear metals) and water. These are the contaminants which if allowed to remain in the engine will contribute to deposits and increased wear.

CI (*Chloroform Insolubles*) — Total solid contaminants less the chloroform-soluble resins. Water has also been removed. These are basically the hard abrasive contaminants contributing to wear. When they reach the limiting value set, it is an indication that filters and/or oil should be changed.

CS (*Chloroform Solubles*) — These are the resins soluble in cholorform. They are potentially materials that form lacquer, varnish, and gummy deposits that eventually decompose to hard carbon. Normally, these materials are filterable and a limiting concentration is used as an indication to change filters.

Note: *In lab reports given some data is given in percentages by weight, others by volume. Difference lies in the technique used. Volumes are generally produced by simple centrifuging; weights by the Gooch method using a static clay media and vacuum filtration. Since charts shown comparatively are in the same terms, techniques used are not important.*

TEST A—Paper-Disc Type Filters in use 199 hours.

Sump Oil before Centrifuge and Filters

Sample No.	% by Volume PEI	CI	CS	Clay-Extracted Resins, % by Wgt.	Dilution %	Vis SSU at 100°F
7A	0.25	0.06	0.19	1.00	*	882
	After Centrifuge only					
7B	0.20	0.05	0.15	1.00	*	900
	After both Centrifuge and Filters					
7C	0.50	0.01	0.04	0.84	0.80	917

TEST B—Waste-Type Filters in use 99 hours

Sump Oil before Centrifuge and Filters

Sample No.	% by Volume PEI	CI	CS	Clay-Extracted Resins, % by Wgt.	Dilution %	Vis SSU at 100°F
8A	0.02	Tr	0.02	1.10	*	876
	After Centrifuge only					
8B	0.02	Tr	0.02	*	*	872
	After Centrifuge and Filters					
8C	0.02	Tr	0.02	1.00	1.20	848

* Remained constant

It can be seen that the paper-Disc type filters did a better job than the waste-type in this instance. The differance of hours on each type (both low) should not affect the filtration results to any marked degree. Dilution remained constant, however viscosity was affected to some extent. Resins are also somewhat lower.

The general point to be made is that in a given situation, the type of filtering media can affect the results obtained. Similarly, a change in the type of oil or of the fuel being used would also affect the results and hence the selection of filtering media.

How fuels affect lube oil filtration . . .

The tightest engine in the world still has some blowby. Fuel soots, byproducts of combustion (as well as partial combustion), water vapor and gases will get past the piston and rings into the engine base. These contribute to the contamination of the sump oil.

It follows, then, that the higher the level of fuel components contributing to PEI, CI, CS and resins, the greater the effect on the lube oil and the more the need for tailored filtration to meet the challenge.

An interesting point should be made here with respect to resins. Up to a point, the buildup of chloroform solubles or resins can be an aid to filtration, particularly of paper-type filters. It has been noted that with a new charge of HD oil and new filter cartridges it takes time to reach the point of maximum filtering efficiency.

There's nothing wrong with the oil or the filters; it's just that the full-strength dispersants are holding blowby contaminants in finely-divided form. It is difficult for the filtering media to remove these fine colloidal particles. Actually, these do no harm. When the oil has enough running time on it to absorb some of the natural resins, they tend to form a coat over the media that greatly aids filtration.

Now, let's show that fuel composition and used lube oil have some connection. At the same time, the importance of proper fuel cleaning is demonstrated. The following laboratory report is an analysis of the sludge taken from two centrifuge bowls. The fuel is a selected residual oil of the type used for enrichment of manufactured gas. It was also used in this case as engine fuel. The lube oil sludge is from the engine in which it was burned.

A—Fuel Sludge

% by Weight PEI	CI	SC	Ash	Specific Gravity Oil-Free Sludge
62.00	62.00	1.00	50.00	0.63

Contents of Ash— 19.50 silicates
30.50 iron oxides

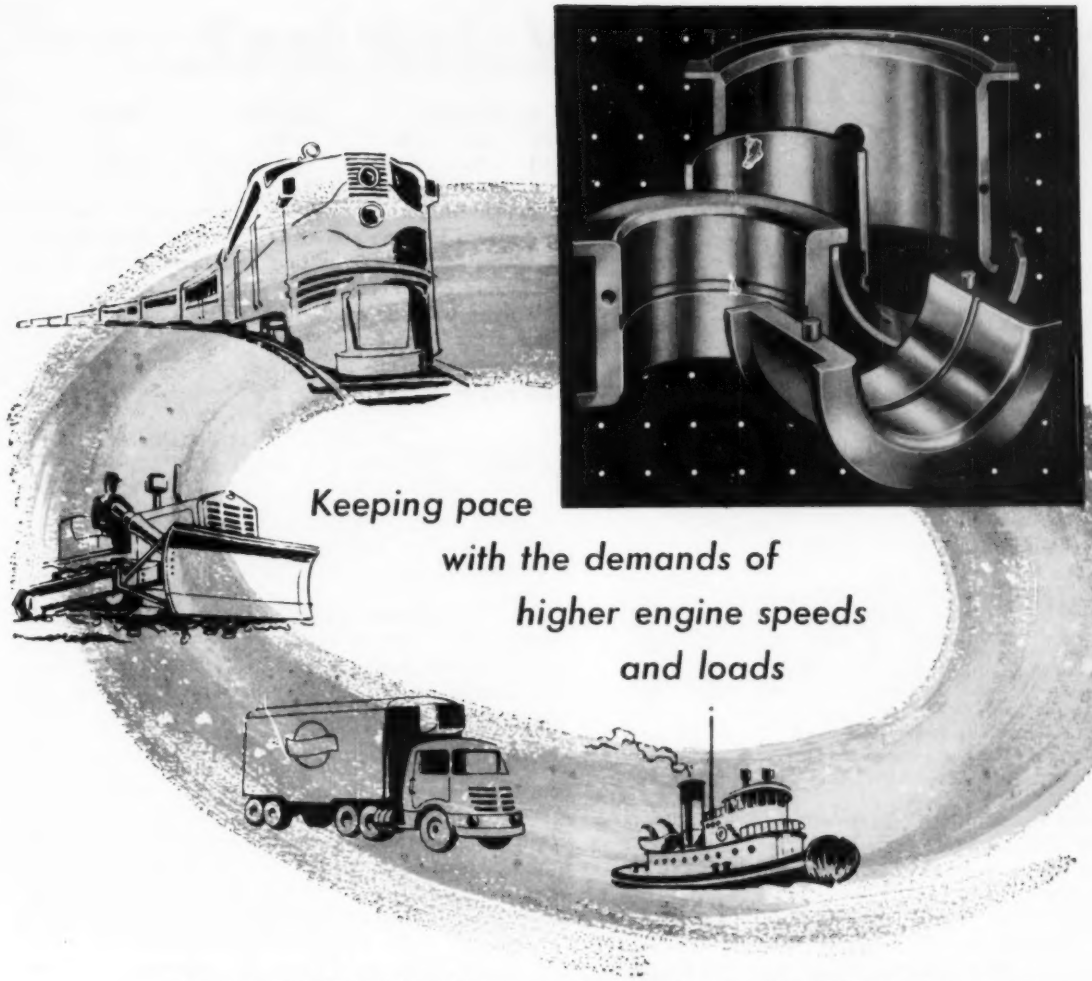
B—Lube Oil Sludge

% by Weight PEI	CI	CS	Ash	Specific Gravity Oil-Free Sludge
52.10	47.30	4.8	6.16	0.504

Contents of Ash—1.24 silicates
4.92 iron oxides

In the fuel sludge, note the high ash percentage and the low CS value. Obviously, the centrifuge has most effect on the denser ash particles and a good thing too. Bulk of the lube oil sludge was carbonaceous fuel soot resulting from blowby. Ash is relatively low, thanks to effective removal in the fuel centrifuge. This is also reflected in the difference in specific gravities.

Where very heavy fuels are used, most of which contain a high degree of contaminants, use of a centrifuge ahead of the filters is indicated. The reason is largely economic. Filters alone could do a creditable job as evidenced by the fact that centrifugal purification is always followed



Johnson Solid Aluminum and Aluminum-On-Steel Bearings

For better performance, and to meet the demands of engine manufacturers, Johnson Bronze pioneered the development of solid aluminum and aluminum-on-steel bearings.

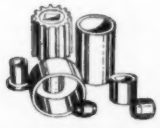
Solid aluminum bearings carry loads up to 4000 psi, and aluminum-on-steel to 6000 psi. These bearings have excellent embeddability properties, are ductile enough to conform to slight misalignments, and have high resistance to acid formation and attack by additive oils.

Johnson aluminum bearings are available in a wide range of plain or flanged, full or half bearings, with or without precision overlay. Take advantage of our years of experience in aluminum bearing design and production—your Johnson representative will be glad to work with you in improving the performance of your engines.

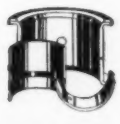
Johnson Bronze

470 South Mill Street • New Castle, Pa.

JOHNSON Bearings



POWDER METALLURGY—BRONZE OR IRON



ALUMINUM ON STEEL SOLID ALUMINUM

BRONZE ON STEEL

STEEL AND BABBITT

GRAPHITED BRONZE

BRONZE—CAST OR ROLLED

What do fuel filters remove? Right filter picked up 200 grams of dirt of which 84.50% was chloroform soluble resins. Removal of these materials helped lube filtration extending filter life and enabled lube oil to be kept in good condition.

up by filtration. However, high viscosity, resulting in low flow rates, and large dirt loads mean that filtering area would have to be extremely large and changes would be very frequent.

As fuels become lighter, filters can and are doing the job. The big point to remember is that since fuel contaminants adversely affect lube oil filtration, the more complete the filtering of the fuel, the less will be the problem of filtering the lube oil. Therefore, choosing the right filter can be very important.

What do filters remove?

Again, we must talk about both fuel and lube oil filtration. First, let's take the case of a cartridge that had filtered 2000 gal of No. 2 Diesel oil.

An analysis report showed:

Dirt and oil on cartridge	927 grams
Dried oil-free dirt	200 grams
Analysis of Dirt by Weight	
Chloroform soluble resins	84.50%
Ash (iron oxide, trace silica)	6.30%
Other volatile and organic matter	9.20%
	100.00%

Other tests may show widely varying proportions of ash. This could be largely dependent on the condition of the storage and supply system as well as cleanliness precautions observed at all stages of fuel handling. However, in all cases the bulk of dirt was due to chloroform-soluble resins.

Now, let's follow through on the engine using this fuel. Cartridges were in use for 522 operating hours. Analysis of the lube oil showed the following:

% by Volume			Dilution	Water
PEI	CI	CS	%	%
0.15	Tr	0.15	5	0.05

Straight mineral oil was used in these engines and was not changed for long periods of time. Combined efficiency of fuel and lube filtration was keeping the oil in satisfactory condition.

Analysis was also made of the dirt caught by these filters, some 7.5 lb per cartridge.

Analysis of sludge

Oil	58.34%	4.38 lb	(calculated)
Carbon	27.52%	4.06 lb	"
Water	10.00%	0.75 lb	"
CS resins	2.52%	0.19 lb	"
Ash (mainly ferrous oxides)	1.62%	0.12 lb	"

The carbon is largely accumulation of fuel soot; water, probably the result of condensed water vapors; resins are contributed by the fuel and to some extent the lube oil; and ash can also be partly from the fuel but is also contributed by dirt getting into the engine, wear metal, etc.

So far no mention has been made of neutralization number, the acidity of the oil. As with other used-oil characteristics, a limiting value must be set, beyond which point something must be done. A case in point is the Newton Falls, Ohio, Municipal Power Plant. A figure of 0.10% for the PEI and/or 0.4 for neut number has been set as the time of filter change.

The effect of the change is to reduce the PEI value and as total resins are reduced, the neut number is also reduced. At Newton Falls, neut number was approaching 0.4 after the cartridges had been in service 961 hours. A total of 142 lbs of sludge were removed with the 14 cartridges and both PEI and vent number subsequently reduced to permit the oil to be continued in service.

Summarizing . . .

Both fuel oil and lube oil filtration is important and must be the best possible balance between filtering effectiveness and costs. Data has been presented to show the following:

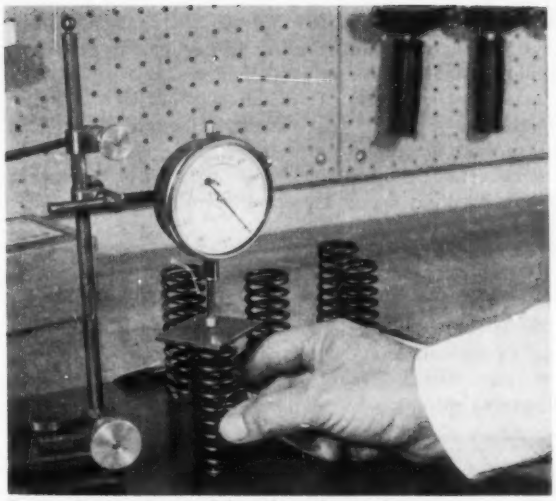
1. Some fuels affect the degree and quality of lube oil filtration. Fuel filtration is therefore important both for protection of injection equipment and to aid the lube oil filtering job.
2. Bulk of total contaminants in the fuel is of a resinous nature.
3. Neutralization number rises as total clay-extracted resins rise in the oil and filters often can be effective in reducing it through resin removal.

Most important, recognize that there is a difference in filters and their effectiveness under a given set of conditions. You would give close attention to both selection and application of filters. Ask for and you can get a lot of practical technical assistance. You'll get maximum oil and cartridge life as well as reduced engine wear and maintenance, all important cost factors to you.

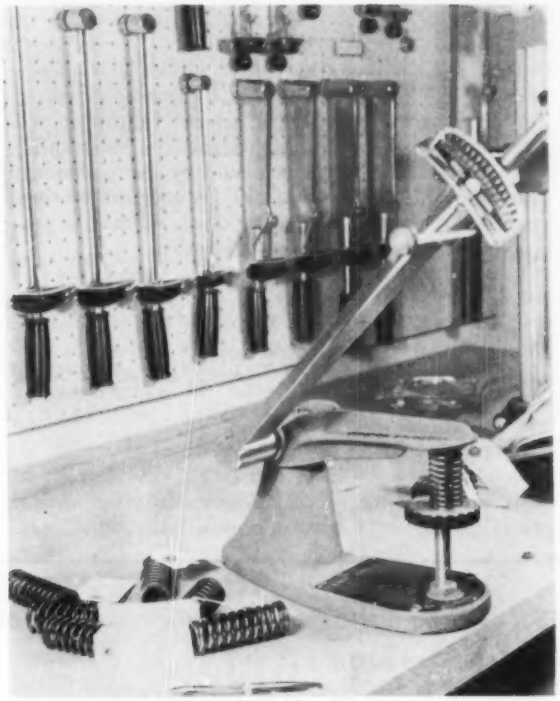
Test ALL Valve Springs

BY L. A. STURTEVANT

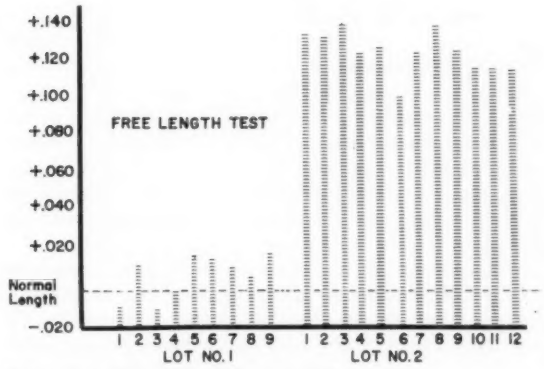
Do you test and replace only faulty valve springs during head overhauls? Or do you automatically replace them all? Here is some evidence to show that no matter what your practice, you should always test springs.



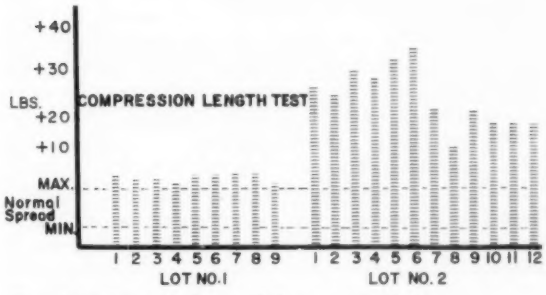
Testing for free length. Taken alone this is not always a reliable guide . . .



Compressed length test is taken with a torque wrench and valve spring tester . . .



Only one of these two lots of new springs comes close to the normal free length mark.



although lot one is the better of the two, note that not one spring falls within the normal spread.

ENGINES know that proper valve spring pressures are important. People sometimes overlook this fact. It's a mistake because the wrong pressure—either too high or too low—can have pretty drastic effects on overall engine service life and specifically on the whole valve system.

In May, 1959, DIESEL POWER had an article based on a survey that covered the subject very well. Just summarizing briefly, low spring pressure allows the tappet, carrying with it the rest of the valve gear, to "ride off" the cam nose at the top of lift. This means a free fall back into contact.

(*Continued on page* 40)

Test all valve springs (*Continued from page* 39)

At best, high impact forces occur, resulting in high wear, accelerated fatigue and possibility of chipping and cracking hardened surfaces. At worst, free fall of a valve on its seat can cause "tuliping" of the valve head or stem breakage.

High spring pressure overloads all valve gear components. The extreme unit loading can result in increased wear. Also, there is a tendency toward valve stem stretching.

Of course, all of these things do not happen immediately. The rate of deterioration depends on several things including how far the springs are from design conditions. The big point is that the engine's service life is being shortened and during the process, performance suffers.

An interesting part of this survey dealt with field practices during overhauls with regards to valve spring replacement. Though engine builders overwhelmingly recommended spring testing and replacement of those found faulty, roughly 50% of all shops indicated a preference to replace all springs automatically.

Among the reasons given for this preference was an economic factor: the labor cost for cleaning and testing springs was roughly a standoff with the cost of a new set. There can be no argument with this fact as stated but one important thing was overlooked—*even new springs should be tested.*

Why test new springs?

There's only one reason for testing new springs—to see if they have the proper pressure. In some ways a spring is tougher to make the specification than, say, a piston. Yet while many people are willing to take the springs' characteristics for granted, they'll check ring clearance in the piston grooves and piston-to-liner clearance even though all parts are new and subject to factory quality control.

Experience with lots of springs has shown that even when new there is considerable variation in them. The chart is a graphic illustration of this. The springs are for a popular diesel engine and were purchased from two different sources. While one set is much better than the other, not one spring fell within the minimum-maximum compressed-length specifications of the engine builder.

Another point to be made from this test is that both free-length and compressed-length tests should be made. The easiest test, free length, taken alone is not a reliable guide. Note Spring No. 6, Lot 2. While it has the shortest free length of the lot, contrary to normal expectation it had the highest pressure at its compressed length.

Obviously, Lot No. 1. is the best bet. It's a better quality control job with primary attention to holding compressed-length pressures consistent. This is where it counts. The springs might well be expected to fall within tolerances after taking a preliminary set after use.

So test all springs . . .

Springs may be cheaper than the labor cost of cleaning and testing but are never cheaper than the results of a bad job. If you grant the importance of having proper valve spring pressures, and it's hard not to in view of all the evidence, it makes sense to take the little extra time to test valve springs, whether used or new.

Effective application of high speed engine turbocharging . . .

(*Continued from page* 30)

noticeable in the service.

"With those turbocharged engines that we have tested in tractor shovel service, we determined by test that these turbochargers took from 12 to 25 seconds to reach full rpm and push enough air into the engine to use the fuel supplied. Overfueling and poor combustion due to air shortage during the directional changes in the short cycle is evidenced by heavy exhaust smoke.

"We feel that a naturally-aspirated or mechanically-driven supercharged engine is a "must" in our tractor shovel loading cycle. The Trojan 304 has a GM '4-71' diesel or a Cummins JS-6-B1 supercharged engine. These engines accelerate rapidly to full power in response to accelerator pedal movement. The exhaust shows a faint haze under all conditions of part load and full load, indicating the best in fuel utilization."

Mr. Jacobus' opinions represent the thinking of one equipment builder. In any case, it shows that if the response rate of a particular engine-turbocharger combination is not fast enough to match the requirements of the work cycle involved that the main values of turbocharging are not realized.

Again, the turbocharger and the process of turbocharging is not at fault; it is just that the particular performance characteristics of turbocharged engines are not the best match for the requirements.

There's always change . . .

Turbocharger builders have not stood still. Today's units are vastly better than those of even a few years back. Rotor inertia has been pared to the bone by reducing mass, better bearings and improved aerothermodynamic design. Also, AiResearch has their controlled pressure boost system designed to improve turbo response, particularly at low load levels.

Another thing is that the engine builder's demands that the turbocharger, as an engine component, have the same serviceability and life as the rest of the engine is being met. There have been tremendous advances in ruggedness and reliability. Service availability and the cost picture is improving.

The field is moving so fast that turbocharger application requires constant re-evaluation. What was true yesterday may not be true tomorrow. However, certain principles will always apply. In a nutshell, don't overpower and expect economy. Also, be sure that performance characteristics of the particular engine-turbo combination are suitable for the anticipated work cycle. Do this and you won't suffer "disenchantment" with high-speed turbocharged engine performance.

SCHOOL BUSES . . .

(*Continued from page* 20)

the additional cost for diesel power? Local conditions vary, it is not possible to give an unqualified "yes".

Only a few years back it would have been an unqualified "no", but things have changed. A new crop of smaller engines suited for such use has been introduced and the cost spread between gasoline and diesel engines is narrowing. Also, there's been a change in thinking. Once, the diesel was pictured only for long-haul, severe service. Now it is recognized that some of the greatest economies are obtained in stop-and-go type of service.

And if you've ever followed a school bus on a 2-lane road in a "no-passing" state, you know that there is no greater "stopper-and-goer" service. Annual mileage is low. According to the U. S. Bureau of Public Roads, the 1957 annual average of school and non-revenue buses was 11,556 miles. Average miles per gallon was 9.94.

In Europe where diesel power predominates in this service, figures indicate a 45 to 50% reduction in fuel used. This is generally confirmed here in taxi service and in some initial light load/short haul installations. At least it's in the same ball park and at 11,000 to 12,000 miles per year should save from $140 to $180 in fuel costs per year.

Additional savings come through reduced maintenance. Again borrowing on performance data from abroad, at these average mileages, no major maintenance should be required for a 10-12 yr period or roughly the life span of such buses. Higher availability could also mean fewer buses to do the job, an attractive capital savings.

Breaking the Ice . . .

So far, this discussion of a potential market has leaned heavily on foreign data and statistics. Now, we point to Cerlist's pioneer installation.

In April, 1959, a school bus of the State of North Carolina Board of Education was repowered with their Model 3 diesel engine. It serves the students of Alexander Wilson School on Highway 54 south of Graham, N. C. Normal operation involves a 28-mile daily round trip. The short operating period prior to the close of school did not produce conclusive facts and figures but did evoke considerable optimism.

This bus is an I-H Model L160 with a gross vehicle weight of 16,000 lb. Capacity is 67 children. The 170-cu in. Cerlist engine, rated 85 hp at 3000 rpm, replaced a 240-cu in. gasoline engine rated 140 hp at 3800 rpm.

Installation was simple, requiring no change in drive line or tires. The 3-cyl, 2 cycle engine being shorter than the 6-cyl engine it replaced, had plenty of room. In fact, an adapter ring on the flywheel housing and an adapter hub on the flywheel were used to move the engine forward to place the fan at the right distance from the radiator.

Front support brackets for the engine were fabricated and secured to the chassis' front cross member. A removable panel was provided in the firewall for access to the timing adjustment of the fuel pump drive gear.

This was the extent of the modifications. All the work was done by Cerlist at their Burlington, N. C. plant. From the limited service to date, one fact is already apparent; fuel consumption is 10.6 mpg compared with the former 6.1 mpg. Mr. Brown's statement comments generally on performance.

Cerlist 85-hp Model 3 makes a neat simple installation in this I-H L160 bus.

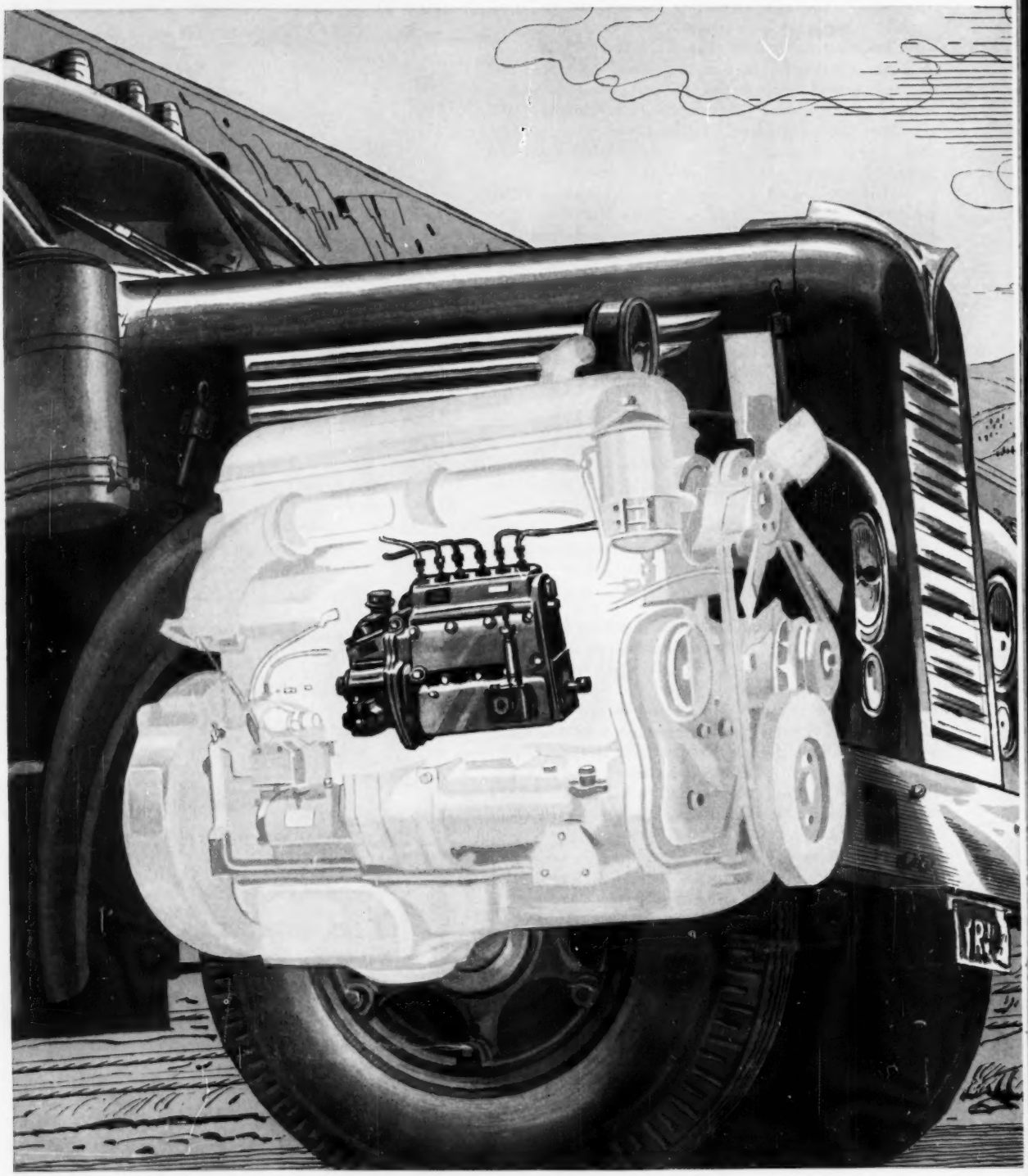
Will we have diesel school buses?

There's good possibility that there will be diesel school buses as the whole program of diesels for lighter vehicles progresses. Economics will decide when and where they will pay out. But these economics and the sales potential will never be uncovered without imaginative thinking and constructive selling of the type demonstrated here by Cerlist. In short, markets don't always come ready-made; they often have to be developed.

Here's one to dig into. As we said, it could be a sleeper.

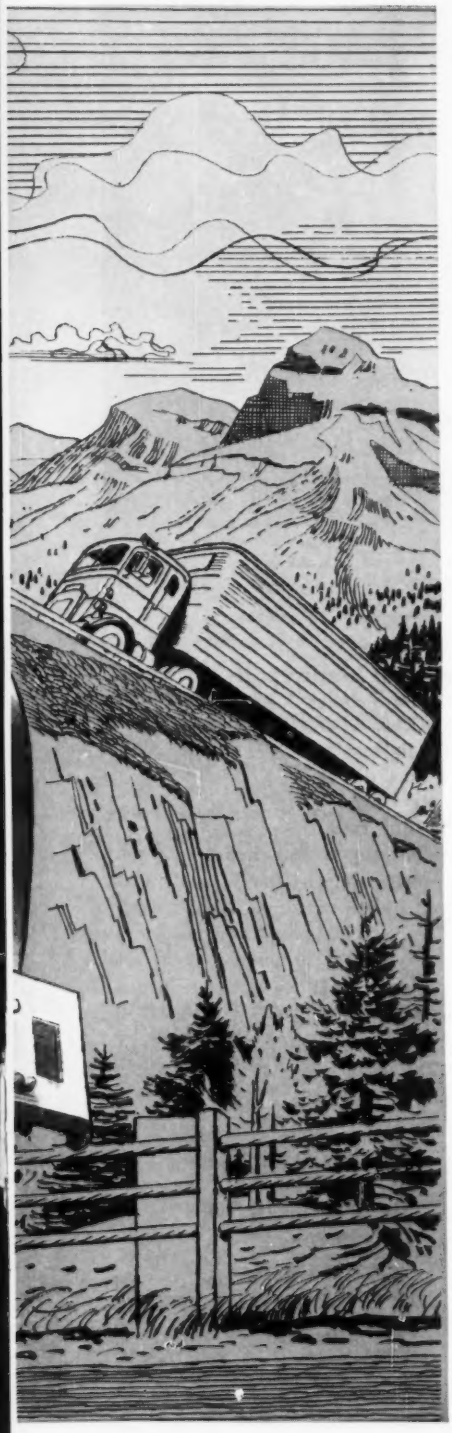
NEW HEAVY-DUTY
AIR STARTING MOTOR
50% MORE POWER...
USES 30% LESS AIR...
10 LBS. LIGHTER...
SIZE 10 BM Air Starting Motor (for diesel displacement from 400 to 2300 cu. in.—gas or gasoline from 800 to 4600 cu. in.).
Outperforms all other air starting motors of comparable size. Fully interchangeable with electric starters, with these important advantages:
• faster starting in any weather with no power loss
• eliminates expensive electrical components and costly maintenance
• lighter weight for more payload
• fewer highway repairs
18-921
For details on I-R's complete line of Air Starting Motors send for your copy of "Go-Modern—Start With Air".
Ingersoll-Rand
11 Broadway, New York 4, N. Y.

28 times around the world



...and AMERICAN BOSCH IS

without an overhaul!



Seven hundred thousand miles of heavy duty hauling—equivalent to 28 times around the world—without a major engine job! Two major trucking lines report that diesels equipped with American Bosch fuel-injection systems have rolled up this remarkable mileage.

Wherever diesels move, they move with American Bosch fuel-injection systems—systems that feed exactly the right metered amount of fuel, with split-second precision, thousands of times per minute. American Bosch is the largest independent producer of diesel fuel-injection systems in the Nation.

American Bosch fuel-injection systems are used as original equipment by the following diesel manufacturers: Mack, Allis-Chalmers, Alco, International Harvester, J. I. Case, Waukesha, John Deere, Minneapolis-Moline, Continental, Hercules, Dominion Engineering, White, Worthington, Cooper-Bessemer, Nordberg, Oliver, Chicago Pneumatic, Baldwin-Lima-Hamilton, American Marc, Witte, Fairbanks-Morse and many others.

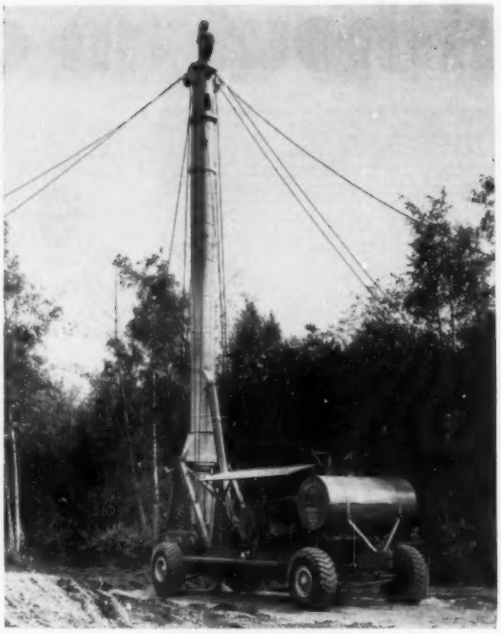
Fuel-injection systems are only one of many important industrial, consumer and defense products made by American Bosch: hydraulic starting systems, actuating motors, pulse generators, magnetos, windshield wipers and many more. American Bosch, Springfield, Massachusetts, a division of American Bosch Arma Corporation.

6748

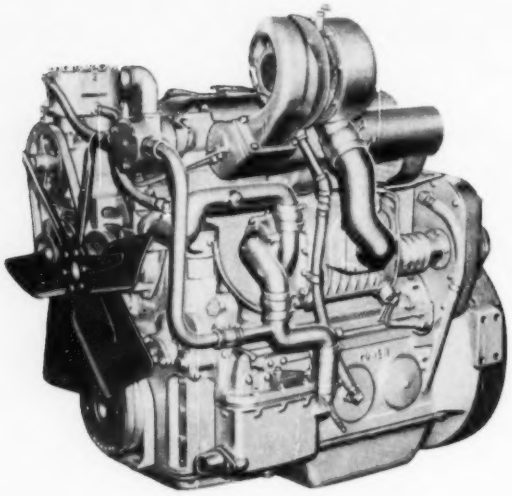
AMERICAN BOSCH ARMA
CORPORATION

THE HEART OF THE PICTURE

diesel power new products

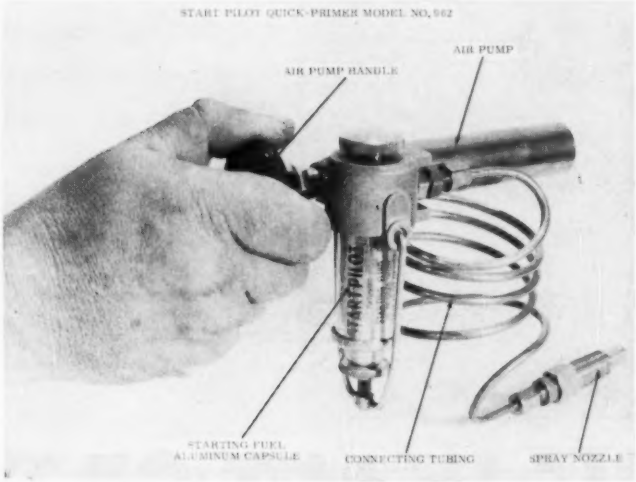


New concept in spar trees is diesel-powered by Cummins 275-hp engine. All components are combined into an integral unit with a common power source. Engine drives through a Gearmatic transmission and torque converter to standard 3-drive yarder. Drive for vehicle, guyline winches, and all other work is taken off the yarder gear train. Sparmatic by the Gearmatic Company Ltd., will be of interest to all in the logging trade as a new, efficient piece of equipment.



P&H announces a new "H" series of lightweight diesels. Line includes 3, 4 and 6-cyl models. Harnischfeger's P&H Diesel Division claims that these are the lightest engines on the market, cites the 4-cyl model which weighs only 1500 lbs dry and produces a 6.32 lbs/bhp ratio. Unique method of turboblowing is also cited.

"One-man" cold-weather starting with a small, low-cost primer, for permanent mounting close to engine starting controls is now available from Start Pilot Corporation. The Quick-primer, Model 962 handles either the 7cc or 16cc aluminum capsules. An engine operator has complete control of starting functions including the amount of starting fluid applied. Pumping can be discontinued the instant the engine fires evenly. Capsules contain from three to five starts and are nationally available through over 1200 Start Pilot distributors, dealers and branches of Mack Trucks, Inc., and the White Motor Company. If you want more dope on this, use the Reader Service Card.



MORE NEW PRODUCTS FOLLOW ►

Fuel-X Diesel Fuel Additive . . .

A new-type fuel additive has been introduced by Fuel-X Corporation. The firm reports that when used in the ratio of a gallon of Fuel-X to 500 gallons of fuel, the additive improves combustion, reduces hard carbon deposits, eliminates condensation, inhibits corrosion, offers a saving in parts replacement. It also reduces smoke levels and air pollution and improves starting.

Effectiveness of Fuel-X is attested by testimonial letters, copies of which accompany the basic company information. One, from Fortier Transportation, Fresno, Calif., tells of testing in five tractors involving both 2- and 4-cycle engines. On the basis of these tests, Fortier states that all fuel for their fleet will now be treated with Fuel-X.

A test with Bunker C fuel oil treated with Fuel-X resulted in almost a total absence of black smoke and a temperature rise of from 275°F to 350°F in the aggregate dryer of an asphalt paving hot plant in less than five minutes.

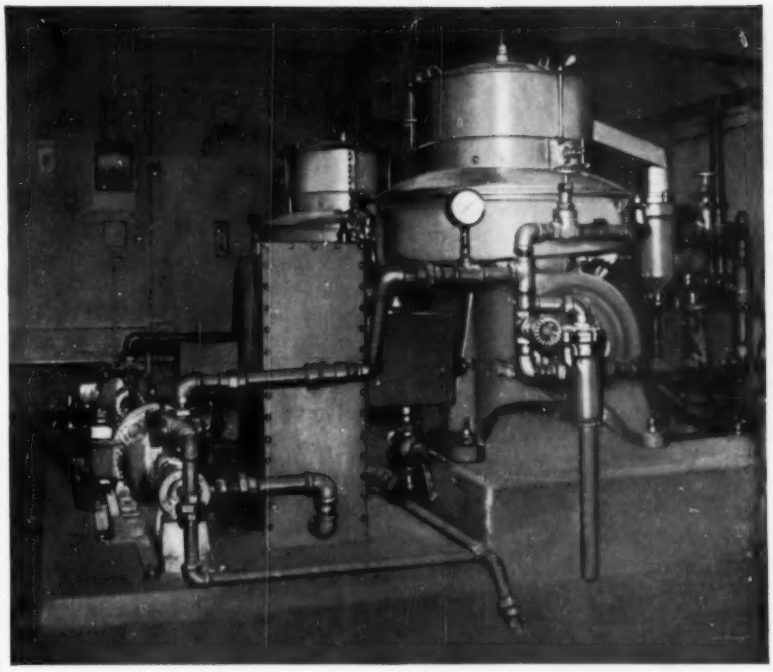
Other test data and more details on Fuel-X are available through the Reader Service Department.

New from Delco-Remy . . .

Looking for an extra output generator for 12-volt negative-ground systems? Here is a new self-rectifying a-c generator with built-in rectifiers. New alternator charging system has a wide performance range and is ideally suited to vehicular operation where excessive idle time is a problem. It is especially designed to handle heavy electrical demands common to today's fleet operations.

Two new regulators — transistor and transistorized are available. They provide long-lasting settings and really boost overall performance. Size and mounting dimensions are the same as standard Delco-Remy regulator.

Have you seen the literature on these new products? A copy of Bulletin 1A-124C describing them is available for you through our Reader Service Department. It is a must for up-to-date electrical system installation.



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With the Gravitrol System, only two products are handled—clarified oil and oil-free solids which settle out in the water phase and are consequently "washed free" of oil.

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THE GRAVITROL PURIFICATION SYSTEM IS AN EXCLUSIVE SHARPLES DEVELOPMENT AND ITS EXCEPTIONAL PERFORMANCE MEANS QUICK PAY-OUT AND CONTINUED PROFITABLE OPERATION.

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* *Trademark and patents pending.*

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diesel power new literature

Flame-Plating Brochure From Linde

Refractory-type metal coatings proving of wide interest. Linde Division of Union Carbide describes its process of Flame-Plating in a new brochure. This is a method of applying thin coatings of hard materials such as tungsten carbide and aluminum oxide to various base metals. You'll get the full story on the advantages of Flame-Plating, where it can be used and suggested applications. Publication also contains a table of physical data for Flame-Plated coatings. Application of these new processes may solve one of your problems. It pays to look into them and its easy to do—use the Reader Service Card.

Lab-Metal Spreads Like Paste—Hardens into Metal

Aluminum Lab-Metal comes in a paste form and hardens into metal which can be drilled, milled, tapped or ground after it has set. It adheres to metal, wood, plaster, glass and plastic. Application is simple, no special tools required. The material will withstand heat to 350° F. Looks like a versatile material that will find a good many uses in shops, foundry work, etc. Made by Alvin Products, free literature and a technical bulletin are available.

Basic Filter Elements Described

A 2-page bulletin from Bendix Filter Division tells about seven basic filter elements and illustrates the materials discussed. Materials provide particle size control from ½ to 250 microns in temperature ranges from minus 350° F to plus 1500° F. Also covered are nine filter assembly and replacement element combinations. Bulletin is three-hole punched for your notebook on filters—its available through our Reader Service Department.

Heavy Fuel and Dual-Fuel Usage Detailed by Enterprise

Here are two highly interesting bulletins from Enterprise Engine & Machinery Company. "The Efficient Use of Heavy Fuels With Enterprise Engines" describes both in words and graphically, a typical Enterprise engine heavy fuel system. The 6-page folder defines heavy fuels, explains how it is possible to burn them and get more economical power.

"Dual-Fuel" details and lists the advantages of this fuel system. It gives a concise explanation of this type of fuel system and explains how Enterprise engines can burn gaseous fuels, including natural gas and sewage gas with pilot injection as well as run on diesel oil.

Both bulletins also cover applications. They are available through the Reader Service Department.

Standard's Truck Stop Story

Standard Oil's Truck Stop Story is about as complete a package as has come down the pike in a while. It not only provides an excellent service for truckers, but offers an integrated program which includes special truck servicing facilities, a truck stop credit card, ticket-printer pumps and a system of centralized billing for truck operator convenience.

About the size of a folded road map the folder outlines the program on 6 pages. A pocket contains cards describing the facilities at various stops in 15 midwest and Rocky Mountain States. It also encloses a map pin-pointing the stops.

Fleet operators will want to find out about Standard's program—it looks like a real time and money saver.

Oil Engine World Directory of Manufactures Published

Temple Press has published the second edition of their world directory of diesel engine manufacturers. It is edited by D. S. Dodsley Williams who also edits the publication "Oil Engine and Gas Turbine."

Copies of the directory may be obtained directly from the publisher, Temple Press Ltd., Bowling Green Lane, London, E. C. 1, England. The price is 75.6d net.

Deutz Diesel-Electric Power Houses

One of the most interesting features of a new publication available from Diesel Energy Corporation is a complete power house layout drawing for a typical three-power unit installation. The pamphlet covers recently erected Deutz diesel-electric power houses in many parts of the world. Descriptions are in four languages. An interesting series of photographs illustrates the publication.

Low Down on Planetary and Star Gears

A bulletin from De Laval Steam Turbine describes space and weight-saving gears for speed reduction or speed increasing service on high-horsepower transmission applications. Bulletin 2401, an 8-pager, hits eight sizes of De Laval-Stoeckicht planetary and star gears used for compressor and blower drives, etc. Well illustrated, it is a complete deal and should be a ready source of information on this subject.

Publications Available from Cooper-Bessemer . . .

Need for small horsepower, heavy-duty integral engine-driven compressors, specially designed for field gathering service, is described in Bulletin 92, "Cooper-Bessemer DM-125 Packaged Compressor 300 Horsepower Class."

This 6-page publication covers the power unit, compressor cylinders used, along with operating characteristics. Units are manufactured by Cooper-Bessemer, then skidded, prepiped and given a closed water system by C-B Southern, Inc. of Houston, Texas.

Another bulletin, this one an 8-pager, details the construction and operating features of Cooper-Bessemer's AM/2 and AM/4 packaged compressors for gas gathering. Bulletin 91 discusses incorporation of large compressor concepts in these compact, heavy-duty units from 100 to 500 hp. Construction details are given on both the 2-throw and the 4-throw types. These units are put together in the same manner as the DM-125.

"Bi-Metallic Casting by Tickle Engineering"

This guide to the casting method of molecularly bonding aluminum to ferrous metals, nickel, titanium, etc. by the Al-Fin patented process is available from the Arthur Tickle Engineering Works. The brochure illustrates applications and a representative selection of Al-Fin constructions in varied industrial fields.

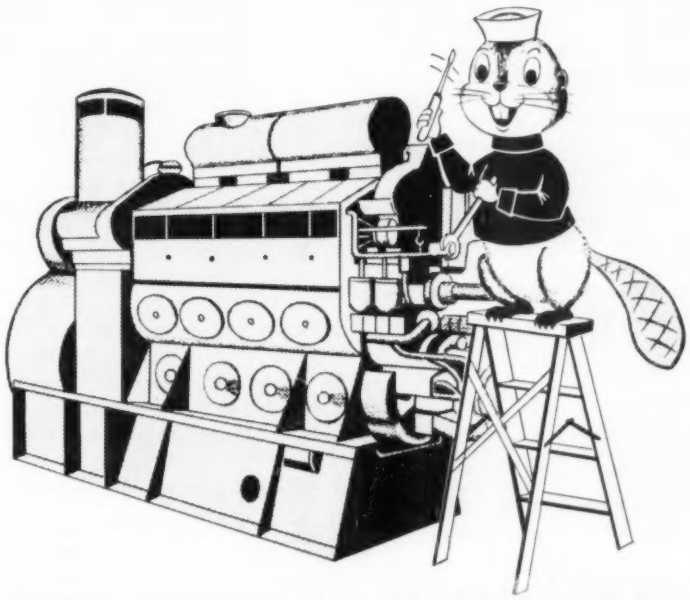
Al-Fin construction might offer the answer to a design problem involving heat transfer, joining, bearing surfaces, abrasion and wear resistance, weight saving, cost reduction, or oxidation resistance. This brochure, and a handsome one it is, could be what you're looking for. Use the Reader Service Card to obtain a copy.

Condensed Catalog From Weatherhead

Anyone who has frequent use for brass and steel tube fittings, tube working tools, hose ends and assemblies will find this 16-page publication most helpful. It offers a comprehensive listing of Weatherhead products most frequently used in hydraulic and pneumatic systems. Easy to use, this condensed version of the larger Weatherhead catalog described previously in DIESEL POWER, is broken into five sections so that items are simple to locate. You'll want to have this catalog on hand for ready reference.

Hercules Closed and Open Power Units Described

Two-page bulletin, No. P.U. 506 describes the 3-cyl DD-169 direct-injection diesel units which are rated to 46-hp at 2000 rpm. The bulletin covers specifications, dimensions and standard equipment. A fold out flap has a power chart. Model DD-169 power units are available as either closed or open units. For free copies use the Readers Service Card.



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PEOPLE AND PLANTS . .

(*Continued from page* 17)

edge and sound selling practices in promoting the sales and acceptance of AAF products to the maximum benefit of the customers and the company."

In addition to receiving a plaque, the annual winner will also be given 10 shares of AAF common stock.

Boedecker Elected VP of Robert Bosch Corporation

Mr. William Boedecker has been elected a vice president of the Robert Bosch Corporation. He has been with the firm for many years. Robert Bosch Corporation is the distributor in the U.S.A. for products manufactured by Robert Bosch G.m.b.h. Stuttgart, Germany.

Appointments . . .

● W. C. Fischer has been appointed director of engineering for Fairbanks-Morse. Mr. Fischer was formerly manager of engineering of the firm's Beloit Works. He has been with Fairbanks-Morse since 1935. Mr. Fischer succeeds Gordon R. Anderson who has been appointed vice president and general manager at Beloit. Mr. J. W. Chandler has been appointed manager of the St. Paul Branch of F-M.

● Alfred M. Boehm has been appointed manager of Power Engine Sales and Howard C. Barten has become manager of Engine Compressor Sales at Worthington Corporation's Buffalo, N. Y. Compressor and Engine Division. Move was effective last September 1.

● Enterprise Engine & Machinery Co., a subsidiary of General Metals Corp., has appointed J. E. Barthmaier Northeast district manager, with headquarters in N. Y. City.

● John J. Serrell has been appointed vice president in charge of sales throughout the world for the Sharples Corporation. His offices will be at the main plant in Philadelphia.

● At Construction Machinery Division, Allis-Chalmers Manufacturing Co., James A. Scoggin has been named to the newly created position of general service manager. J. T. Skinner was appointed sales manager, Deerfield Products, and Francis C. Schessler has been appointed assistant sales manager for Deerfield line.

● Tom M. Lamberth, Jr. has been promoted to the post of assistant to Southwest district manager at Cooper-Bessemer. His former position as branch manager of the Shreveport office has been filled by Mr. Clifton W. Woltz. J. M. Brannaman is the new branch manager for the newest Cooper-Bessemer field office in Pittsburgh.

● Nordberg Manufacturing Co. has announced the appointment of Donald E. Byrnes as assistant sales engineer in the Dallas office. In his new position Mr. Byrnes will assist M. R. Wall, district manager.

● James A. Seaman is the new Southeastern sales manager for Van Norman Machine Co. division of Van Norman Industries. Mr. Seaman will headquarter in Atlanta, Ga. Roy N. Slack is now division manager of Van Norman Southern Texas territory with headquarters in Houston.

● R. W. Howard was recently elected vice president of Gillett & Eaton, Inc. Howard's previous post was with Gould-National Batteries, Inc. with whom Gillett & Eaton are affiliated.

Expansion . . .

● Snap-on Tools Corporation announces the acquisition of the outstanding common stock of Judson Engineering Corporation, Natick, Mass. Judson is a manufacturer of automotive wheel balancing and aligning equipment.

● Stewart & Stevenson Services, Inc. Engineering Department is expanding both physically and in its areas of operation. Company's engineering section is now housed in new quarters in Houston, Texas. In the past 12 months Stewart & Stevenson has greatly widened the scope of its power application work by contracting complete, turnkey jobs.

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● Mack Trucks, Inc., has broken ground for a new quarter-million dollar home for its Providence Branch. New Providence headquarters for Mack was made necessary because of increased sales and service activity in the area. Completion date is estimated for March, 1960.

● Allis-Chalmers International has announced purchase of an Italian firm for manufacture of crawler tractors and spare parts. The firm is Vender S.p.A. in Cusano near Milan, Italy. New plant in Italy will provide Allis-Chalmers and its dealer and distributor organizations an opportunity to take advantage of the many market potentials in the European Common Market countries as well as the surrounding countries.

● Proposed purchase of the assets of The Rotor Tool Company of Cleveland by Cooper-Bessemer has been announced. Proposed purchase of Rotor Tool by Cooper-Bessemer will make a new service available to industry. Complementary product lines of the two companies will extend the scope of services to market a complete, integrated air-supply, air-tool production facility.

● G. B. Shandley, formely Service Manager in Houston for Stewart & Stevenson Services, Inc., has acquired a half-interest in the Rutledge Diesel Supply Company of Wichita Falls, Texas. Company is a dealer in the Wichita Falls area for Stewart & Stevenson Services, Inc., exclusive General Motors diesel distributor in Texas. Later this year Rutledge will change its name to R. & S. Diesel Supply Company.

● Home office of Roper Hydraulics, Inc., has been transferred from Rockford, Illinois to Commerce, Georgia. New mail address is Post Office Box 269 and telephone number is FEderal 5-3121. New plant location is about 60 miles northeast of Atlanta.

● Continental Motors has bought the real estate and plant of the Novi Equipment Co., Novi, Michigan together with the machinery and materials inventory of Novi's Governor Division. Plant is now operating as the Novi Division of Continental Motors, producing governors for a substantial part of Continental's industrial engine output.

● General Mills, Inc. has announced the acquisition of the business and assets of Magnaflux Corporation of Chicago. A pioneer in the development of techniques and equipment for detecting hidden flaws in industrial materials. Magnaflux will continue in business at its present location in Chicago and under the same name as a wholly-owned subsidiary of General Mills.

● Perfect Circle goes international with the purchase of all capital stock of Platka-Export and Platka Western Hemisphere Trade Corporation and formation of Perfect Circle International. Headquarters will be in Fort Wayne, Indiana. Also announced was the purchase of 80 acres of land near Rushville, Ind. for construction of a $3-million piston ring foundry. Facility will have triple the production capacity of the Rushville foundry it will replace.

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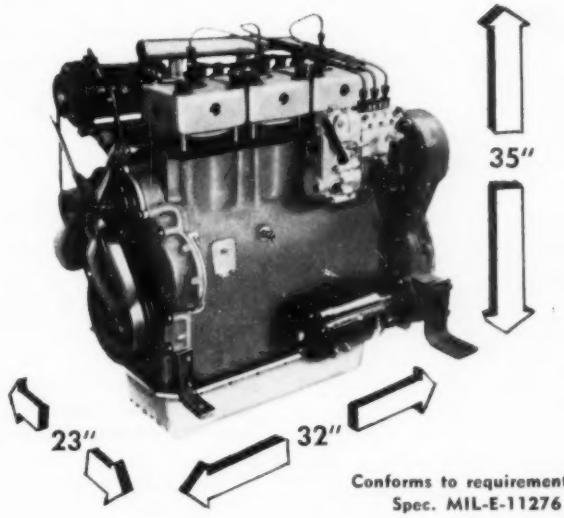
MODEL 3

AUTOMOTIVE • INDUSTRIAL • MARINE



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● 85 HP AT 3000 RPM

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● 65 HP AT 2600 RPM

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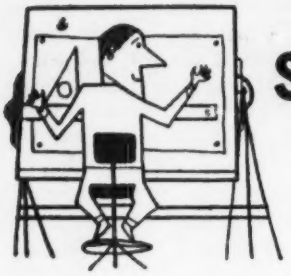


service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

Find Cause of Oil Loss before Disassembly

Don't automatically blame oil loss on faulty rings. There can be any number of both direct and contributing causes. These should be checked out before an engine is taken apart so that evidence of the real causes are not destroyed. You might save a teardown or at least have a tight engine when you have finished the job.

Perfect Circle makes this point and lists some of the things to check in the "Service Engineering" section of their magazine MAGIC CIRCLE. Here are some of their recommendations.

External Leaks—Sounds pretty basic but such leaks are often overlooked. Leaks at fittings on external oil lines are easy to spot but you should dig deeper. Every gasketed joint exposed to oil—oil pans, covers, filter seals, front and rear main seals, etc.—are potential leakers and should be checked.

Internal Leaks—Know your engine and every oil passage in it. Gaskets and seals may be the only separation between oil channels and the water, intake or exhaust system.

Leakage through valve guides is a frequent contributor to oil loss. If due to wear it can be corrected by parts replacement. However, it can occur with normal valves through over-lubrication and can best be corrected with PC positive valve seals.

Oil getting into the water can be easily detected if you think to check the water. Oil getting into the cylinder, either directly or with the intake air, shows in the exhaust as blue-gray smoke. Eliminate such sources as valve guides, crankcase breather systems, gasket leaks and where used, mechanical blower seals.

Oil flow to various items can be temporarily controlled or blocked during testing to see the effect of each on the characteristic blue-gray smoke. If you've done a careful job and the smoke persists, you can do a ring job with assurance that it will lick the oil loss condition.

Self-Rectifying Generator Diode Checks

Growing electrical loads on mobile equipment are increasing popularity of heavy-duty, high-output self-rectifying a-c generators. Service men will need new test and maintenance data. Here's a brief summary of operation and the *type* of tests conducted on the rectifying elements, diodes. It is from Delco-Remy Service Bulletin 1G-251, "Tests and Maintenance of Self-Rectifying A-C Generators." Get the bulletin for full details.

Diodes are essentially half-wave rectifiers that pass current in only one direction. Alternating current from the generator slip rings reverses direction each cycle. The rectifying circuit is arranged so that one set of diodes passes the positive half of the cycle to the output and blocks the negative half when the current reverses. A second set of diodes passes this negative half to the output and blocks the positive half. Thus, the full a-c cycle is rectified to direct current.

Internal construction of the diodes is such that they are either positive or negative. This is clearly marked on the case and indicates the case's polarity. In addition, negative diodes have right-hand mounting threads; positive diodes have left-hand threads. This prevents incorrect mounting.

Diodes are checked for "shorts" and "opens" by using an ohmmeter. The positive lead of the ohmmeter goes to the positive lead of the negative diode and the ohmmeter's negative lead to its case (negative). Reverse connections are used on the positive diode.

Delco-Remy points out that ohmmeter readings can vary considerably but that if below 300 ohms, the diode is probably faulty and should be replaced.

Open circuits are checked by reversing the connections as explained above. A reading of infinite resistance shows the diode to be open and calls for replacement.

Cam Masters Available for Camshaft Regrinding

Those regrinding camshafts with the Van Norman camshaft grinder will be interested to know that cam masters are available for many diesel camshafts. While the design of the Van Norman machine permits cam masters to be made right on the machine, for greatest accuracy these must be reproduced from an unworn cam. This may mean buying a new camshaft, often an expensive procedure.

Cam masters in sets for specific engines can now be bought at a reasonable price from Republic Welding Company, Louisville, Ky. With these, accurate cam contours can be reproduced and a good many expensive camshafts reclaimed.

Prelubricate Oil Seals

It usually takes a little time for a lubricant to get to a newly-installed oil seal. Dry operation can ruin the new seal right then and there.

Le Tourneau-Westinghouse Company in their book, The CO-OPERATOR, offers the following tips:

Neoprene or other synthetic material seals—Lubricate heavily with a high-

temperature grease, preferably of a different color than the regular lubricant to be sealed. Then if some grease works out, it is possible to tell if it is the prelube material or the regular material.

Leather-type seals—Soak in oil until the leather is thoroughly impregnated.

Two further ideas are passed on: (1) Make sure that the shaft and recesses are clean and smooth so as to avoid seal damage and; (2) use replacement seals of the same material, not substitutes.

Water Conditioner a "Must"

Detroit Diesel Engine Division, GM, points out in their DIESEL SERVICE TOPICS that 2- and 4-valve cast iron cylinder heads for service use on 4- and 6-cyl Series 71 engines are no longer being coated internally. They stress that when these are used on aluminum-block engines it is necessary to install a Perry water filter and conditioner on the engine. These units, available through GM Diesel sales and service outlets are very effective in reducing corrosion, plus doing other water conditioning jobs.

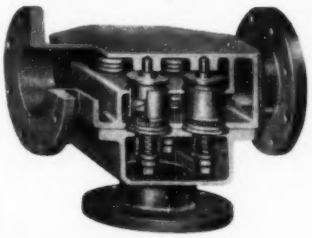
Euclid's Transmission Lubrication

Allison Torqmatic drive units and Fuller transmissions are both used in Euclid equipment. In stressing the importance of proper lubrication of both, Euclid makes the following recommendations:

Allison Torqmatic drives—Only lubricant recommended is Hydraulic Transmission Fluid Type C with a 10W SAE viscosity rating. However, they point out that oils meeting this specification often meet specifications for heavy-duty type engine lubes and are labeled as such. The fact that they are branded as engine oil does not preclude their use in these drives *provided that you are positive that they also meet specifications of the Type C transmission oil.*

Fuller Transmission—Straight mineral gear oil is the only lube recommended. At 0°F to 32°F use SAE 90; 32°F to 90°F use SAE 140.

Specify AMOT Engine Controls



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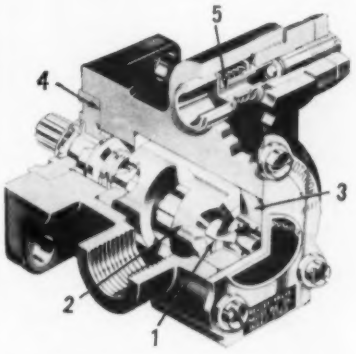

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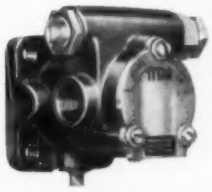
TYPICAL DIESEL PUMP



200 gph rated capacity. Discharge pressure up to 20 psi. Integral fixed pressure relief valve. Weight: 1.8 pounds.

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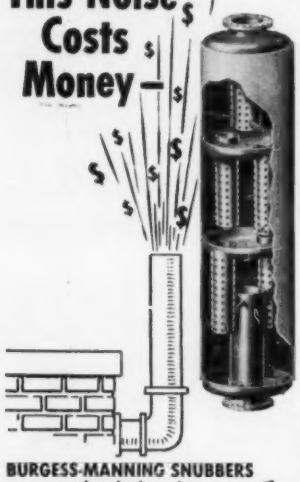

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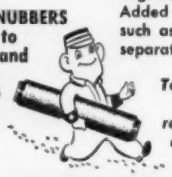

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Sound Engineering

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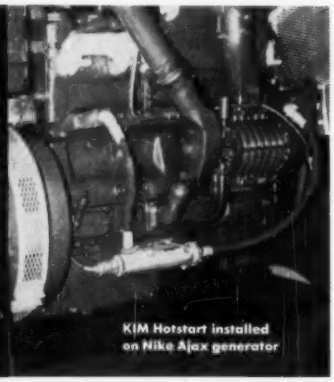
KIM HOTSTARTS keep U.S. NIKE AJAX on all-weather ALERT!



KIM Hotstart installed on Nike Ajax generator

When efficiency is measured in split seconds, "cold starts" must be eliminated. That's why Nike Ajax are now equipped with KIM Hotstart engine pre-heaters. Regardless of weather, they enable operation under full load within seconds. For details on KIM Hotstarts, see your automotive dealer or write us for free literature.

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ENGINE PRE-HEATER

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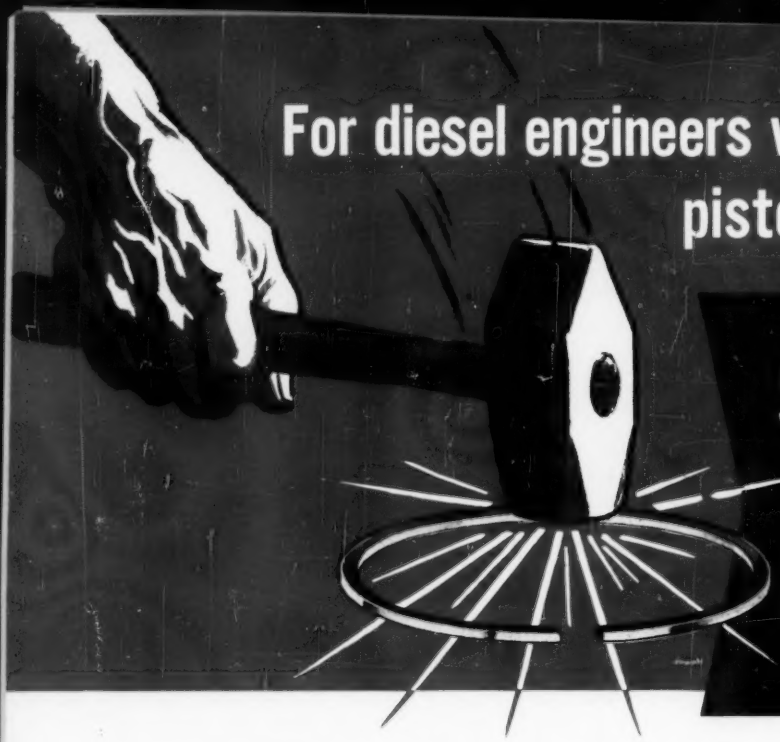

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